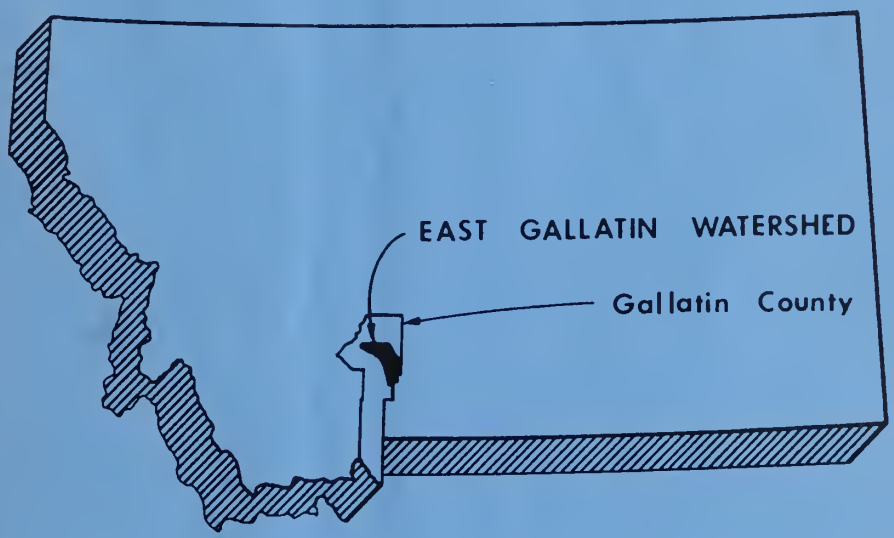
EAST GALLATIN RIVER AND UPPER TRIBUTARIES FLOOD HAZARD ANALYSES

GALLATIN COUNTY, MONTANA



prepared by the
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
in cooperation with the
MONTANA DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION
GALLATIN CONSERVATION DISTRICT
GALLATIN COUNTY
CITY OF BOZEMAN
July 1972

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Bozeman, Montana

Report of
EAST GALLATIN RIVER
AND UPPER TRIBUTARIES
FLOOD HAZARD ANALYSES
GALLATIN COUNTY, MONTANA

Prepared in cooperation with
Montana Department of Natural Resources and Conservation
Gallatin Conservation District
Gallatin County
City of Bozeman

July 1972

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FLOOD HAZARD ANALYSES
EAST GALLATIN RIVER
AND UPPER TRIBUTARIES
GALLATIN COUNTY, MONTANA

INTRODUCTION

In 1971 the Montana Legislature passed legislation to ease the increasing problem of flood loss and damage in Montana. The Montana Floodway Management and Regulation Act, title 89, chapter 35, Revised Code of Montana, authorizes the Montana Department of Natural Resources and Conservation to initiate a comprehensive program of floodway delineation and regulation for the entire state. The purpose of this state-wide floodplain policy is two-fold:

1. To eliminate or minimize loss of life, personal suffering, and physical hardships which are immediate consequences of serious floods.
2. To achieve the optimum beneficial use of our floodplains for both private and public benefits.

Implementation of the State Floodway Management and Regulation Act proceeds in three successive phases. First, areas adjacent to water courses subject to flooding must be delineated. This report supplies the necessary technical data to fulfill the first requirement.

The second step in the implementation process is a public presentation of the floodway delineation lines. This is accomplished at a public hearing where the boundary lines of the 50-year frequency flood are presented and discussed. Following acceptance of the data presented

at the public hearing, the 50-year floodway encroachment lines are recorded in the office of the County Clerk and Recorder. The Department of Natural Resources and Conservation provides the officials of the political subdivision with floodway delineation data, a copy of the State Floodway Management and Regulation Act, rules and regulations of the Department of Natural Resources and Conservation, and minimum standards for land use within the official 50-year floodway.

The third phase in the implementation process is primarily local action. As specified in the state law, the political subdivision must adopt land-use regulations which meet or exceed the minimum standards of the Department within one year after receiving the floodplain delineation data from the Department of Natural Resources and Conservation. If land-use regulations are not adopted on the local level, the designated or 50-year floodway can be enforced by the Department of Natural Resources and Conservation.

Many land uses are compatible with periodic flooding and are permitted within a designated floodway, to the extent that they are not prohibited by any other statute. Some open space uses specifically allowed within the floodway are agricultural uses, industrial and commercial uses such as loading areas or parking areas, and open type public and private recreation areas. In addition, other land uses, including buildings for living purposes or commercial structures and excavations, can be allowed on certain portions of the floodway provided they are adequately flood-proofed.

Specific recommendations on acceptable floodplain land uses and State standards for floodplain development will be furnished to Bozeman

City officials and the Gallatin County Commissioners. Additional information concerning the Montana Floodway Management and Regulation Act and its implementation can be obtained from the Department of Natural Resources and Conservation, Water Resources Division, Sam W. Mitchell Building, Helena, Montana 59601.

Flood hazard analyses are carried out by the Soil Conservation Service as an outgrowth of the recommendations in A Report by the Task Force on Federal Flood Control Policy, House Document No. 465 (89th Congress--August 10, 1966), especially Recommendation 9(c), "Regulation of Land Use," which recommended the preparation of preliminary reports for guidance in those areas where assistance is needed before a full flood hazard information report can be prepared or where a full report is not scheduled.

Authority for funding flood hazard analyses is provided by Section 6 of P.L. 83-566, which authorizes USDA to cooperate with other federal and state and local agencies to make investigations and surveys of the watersheds of rivers and other waterways as a basis for the development of coordinated programs.

In carrying out flood hazard analyses, the Soil Conservation Service is being responsive to Executive Order 11296, dated August 10, 1966, especially to Section 1(4), which directs that "all executive agencies responsible for programs which entail land use planning shall take flood hazards into account when evaluating plans and shall encourage land use appropriate to the degree of hazard involved."

Priorities regarding scheduling, location, and intensity of flood hazard studies are set in cooperation with the Montana Department of Natural Resources and Conservation.

This flood hazard report is on the East Gallatin River and its tributaries, Bridger, Rocky, Bear Canyon, and Bozeman Creeks, in Bozeman and near Belgrade and Manhattan, Gallatin County, Montana. The Montana Department of Natural Resources and Conservation, the City of Bozeman, and Gallatin County requested this flood hazard study to help solve local flood problems and to help determine the best use of land subject to overflow. The report can be used as a technical tool to help develop local floodplain land use and development regulations. The report is based on stream flow records, historical flood heights, and other technical data on the flooding potential along the stream reaches studied.

Ordinarily, flood hazards increase in developing areas. Development and urbanization mean new homes, schools, factories, and streets. This results in less exposed soil to absorb precipitation, producing more storm runoff. Pavements, roofs, compacted soil and storm sewers all increase and speed up the runoff, increasing the flood hazard locally and downstream.

Various land uses in a developing area compete for each parcel of land. Floodplain lands are no exception. Encroachments into the floodplain by land filling, railroads and highways, channel modification,

and other developments constrict the flow of flood water. This increases flood water depths and velocities.

Managers and users of floodplain land should base their use upon the advantages and disadvantages of locating within flood hazard areas. Knowledge of the hazards involved is not widespread and consequently managers, potential users, and occupants cannot always accurately assess the risks. In order for floodplain management to effectively play its role in the development of floodplains, it is necessary to:

1. Provide state and local units of government with appropriate technical information and interpretations for use in floodplain management.
2. Provide technical services to managers of floodplain property to better coordinate planning for development and appropriate land use.
3. Improve basic technical knowledge about floodplain hazards in cooperation with other agencies and groups.

This report contains aerial mosaic maps showing the approximate 50- and 100-year frequency flood delineations along portions of Bridger, Rocky, Bear Canyon, and Bozeman Creeks and the East Gallatin River. The maps also show soils information. Additional information in the form of valley cross-sections, water surface profiles, soils interpretations, and other related floodplain data are also included.

The 10-, 50-, 100-, and 500-year frequency floods were analyzed. A 50-year frequency flood has an average occurrence of once in 50 years or a two percent chance of occurring in any given year. A 100-year flood occurs once in 100 years on the average or has a one percent chance

of occurring in any given year. Only the 50- and 100-year flood lines are shown on the aerial mosaic maps, valley cross-sections, and water surface profiles. Information for the 10-, 50-, 100-, and 500-year floods are shown in floodplain reference tables. Elevations for other frequency storms could be determined from the basic support data on file with the Soil Conservation Service.

This report is intended as a technical basis for determining needed action to minimize flood damages and as a basis for further study and planning on the part of the Montana Department of Natural Resources and Conservation, the City of Bozeman, Gallatin County, and Gallatin Conservation District. Future action could include local planning programs to guide developments by controlling the permitted uses of floodplains through zoning and subdivision regulations, the construction of flood protection works, and combinations of the two approaches. Such solutions could include the following non-structural or preventive measures:

1. Land Use Planning
2. Floodplain Control Regulations
3. Floodplain Development Policies
4. Floodplain Filling Regulations
5. Floodplain Acquisition
6. Floodplain Zoning
7. Upstream Land Treatment Program
8. Flood Warning System
9. Flood Insurance
10. Tax Adjustments
11. Health Regulations
12. Building Codes

Corrective or structural measures which would complement the above include:

1. Floodwater Retarding Reservoirs
2. Channel Improvement
3. Levees and Dikes
4. Pumps
5. Flood Proofing
6. Watershed Treatment

The Montana Department of Natural Resources and Conservation and the Soil Conservation Service will, upon request, provide technical assistance to federal, state, and local agencies and organizations in the interpretation and use of the information developed in this study.

DESCRIPTION OF THE WATERSHED

The East Gallatin River Watershed is in the north one-third of Gallatin County. Nearly all of the drainage area lies in Gallatin County. Approximately two percent of the drainage area is in Park County to the east. The drainage area of the East Gallatin River at its mouth is approximately 642 square miles. The East Gallatin River and the West Gallatin River join north of Manhattan, Montana, to form the Gallatin River, which joins the Madison and Jefferson Rivers at Three Forks, Montana, to form the Missouri River.

The East Gallatin River begins approximately three miles east of Bozeman at the confluence of Rocky Creek (50.3 square miles) and Bear Canyon Creek (21.6 square miles).

Bozeman Creek (also known locally as Sourdough Creek) has a drainage area of 52.4 square miles and flows north through Bozeman into the East Gallatin River at the north edge of Bozeman.

Bridger Creek, with a drainage area of 70.0 square miles, heads in the northeast corner of the County in the Bridger Range. It flows

R5E R6E R7E T1S T2S

T4N T3N T2N T1N T3S T4S T5S

NATIONAL FOREST

Maudlow

Sixteenmile

Zade Mtn.

Sacajawea Peak

Brackett Cr.

Grassy Mtn.

45°45'

Saddle Peak

Dry Cr.

Reese Cr.

LINE

Bridger Mtn.

Green Mtn.

To Livingston

10

N.P.

Rocky Cr.

Bear Canyon Cr.

Mt. Ellis

45°30'

Bozeman Cr.

Overlook Mtn.

Hyalite Peak

Cr.

Trident

Cottonwood Gulch

Logan

Manhattan

Three Forks

BASE

River

East Gallatin River

Belgrade

90

West Gallatin River

BOZEMAN

191

Hyalite Cr.

Church Hill

Camp Cr.

CM.S.P&P

Bozeman Hot Springs

Gallatin Gateway

R2E R3E R4E

LOCATION IN GALLATIN COUNTY

Three Forks
S. Manhattan
Belgrade
GALLATIN
Bozeman

LEGEND

Watershed Boundary

Study Area

5 0 5

SCALE IN MILES

STUDY AREA
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY, 1972

generally south and west into the East Gallatin River approximately one mile north of Bozeman.

The watersheds of all four tributaries are heavily timbered in the higher elevations. Mean sea level elevations vary from approximately 10,000 feet to about 4,700 feet.

The lower reaches of Bridger Creek and Bozeman Creek and the upper reaches of the East Gallatin River are steadily undergoing urbanization. There are numerous farm and ranch headquarters on the floodplain. Recently many residential and commercial developments have been established on these floodplains.

The upper reaches of the East Gallatin floodplain are used for cropland and subirrigated pasture and hayland, while the lower reaches contain subirrigated pasture and hayland with areas of swamp and marshland. This swamp and marshland area provides excellent habitat for waterfowl, game and song birds, deer, and other wildlife.

SOURCES OF DATA

Basic data used in this study include U. S. Geological Survey (USGS) topographic maps, bench marks, and streamflow records; U. S. Forest Service (USFS) maps; Soil Conservation Service (SCS) streamflow measurements; Gallatin County road map; Gallatin Conservation District maps; Agricultural Stabilization and Conservation Service (ASCS) 1965 aerial photographs; Christian, Spring, Sielbach, Associates 1970 aerial photographs; City of Bozeman street elevations and map; and reports of the Civil Engineering Department, Montana State University.

TABLE A

Records from several stream gages in the watershed and surrounding area were analyzed. The following table lists specific gaging stations located in the study area.

Stream Name	Gage No. or Name	Gage Location		Gage Type	Drainage Area Above Sq. Miles	Years of Record	Maintained or Read By
		Legal	Approximate				
Bear Canyon Cr.	6-0470	NW Sec 36 T2S R6E	6 mi. SE of Bozeman	Water-Stage Recorder	17	1952 to Present	USGS
Rocky Creek	6-0465	NE Sec 23 T2S R6E	5 mi. E of Bozeman	Crest-Stage Gage	49	1952 to Present	USGS
Bridger Cr.	6-0485	NE SE Sec 34 T1S R6E	3.5 mi. NE of Bozeman	Water-Stage Recorder	62.5	1946-1969	USGS
Bozeman Cr.	---	NE NE Sec 18 T3S R6E	7 mi. S of Bozeman	Parshall Flume	32.5	Seasonal	City of Bozeman, USFS, & MSU
E. Gallatin R.	None	SW SW Sec 30 T1S R6E	Manley Bridge 2 mi. NW of Bozeman	Staff Gage	221.7	Seasonal 1969 to Present	SCS
E. Gallatin R.	6-0480	Sec 31 T1S R6E	1/2 mi. N of Bozeman	Water-Stage Recorder	148	1939-1961	USGS

Other physical data were obtained from locally available maps and engineering field surveys. Water surface profile determinations were made using available SCS Automatic Data Processing programs to establish elevation-discharge relationships. Flows for various frequency events were determined from a regional analysis of streamflow records available in the area.

The water surface profile elevation-discharge relationships were used to establish flood elevations for the various events at each surveyed cross-section.

Engineering field surveys were made by crews from the SCS in Bozeman and the Montana Department of Natural Resources and Conservation in Helena. Flood lines were located between valley cross-sections by stereoscopic interpretations, additional field surveys, and historical records of high water marks.

Computations at bridges are based on present normal bridge openings. Consideration was not given to possible blockage of bridge openings by ice, sediment, or other debris. Floodplain filling and other encroachments also can affect the computed water surface profiles. Computations for this study considered only conditions in the floodplain at the time field surveys were made. Future floodplain and watershed development and modification will require revised water surface profile computations.

SOILS

The East Gallatin Flood Hazard Soils Study is confined to the floodplain and the adjacent terraces and alluvial fans. The soils of the

survey area are mainly loams and silt loams. All of these valley soils are underlain by deep valley fill of relatively porous gravel and sand. They range from well drained to very poorly drained and have seasonal fluctuating water tables of varying depth and duration. Slopes are nearly level or gently sloping. Some areas have smooth surface topography, but others are very irregular and broken by old shallow stream meanders.

The soils of the area have been grouped into ten mapping units, primarily on the basis of depth to sand and gravel and their drainage condition. These units have been designated as A, B, C, D, E, F, G, H, P, and R. A detailed description and interpretation of these mapping units is found in Appendix A of this report. The basic soil information was taken from the existing detailed soil surveys of farms and ranches scattered throughout the area. This was supplemented by a reconnaissance-type field survey and reflects the recent changes in drainage conditions, stream channels, and land developments. Drainage studies in some areas provided periodic readings of water table depths and seasonal fluctuation; however, vegetative types and present land use practices provided the main basis for evaluating drainage conditions.

FLOODING

Floods on the East Gallatin River and its upper tributaries usually are caused by combined snowmelt and rainfall runoff. Streamflow normally follows a seasonal pattern with low discharges during the fall and winter months. The valley snowmelt, usually beginning in early March and

continuing through April, results in a gradual rise in discharge. During May, June, and early July, mountain snowmelt, combined with rains, usually produce the highest streamflows of the year.

The following table shows the highest recorded discharges in the study area.

TABLE B

Stream Name	Gage No.	Years of Record	Maximum Discharge Recorded cfs	Year Recorded	Estimated Frequency
Rocky Creek near Bozeman	6-0465	15	1230 1/	1971	70
Bear Canyon Cr. near Bozeman	6-0470	14	370 1/	1970	30
Bridger Creek near Bozeman	6-0485	24	902 1/	1953	40
E. Gallatin R. at Bozeman	6-0480	22	1240 1/	1953	20
			1600 1/	1971	35
E. Gallatin R. at Manley Bridge in Bozeman	None	26	2100 2/	1971	20
			1900 2/	1970	15

1/ USGS
2/ SCS

Bozeman Creek has the least reliable records for this study. A single gaging station measures the runoff from 32 square miles, approximately 62 percent of the drainage area. This gage is inadequate to measure large flows.

High waters on Bozeman Creek divide and generally enter the south edge of the city through the main channel and a secondary channel. See

city map on page 14 for location of the enumerated points in the following discussion.

The main Bozeman Creek channel, as it goes northward through the city, has many points where waters can overflow and divide. During flood periods, waters first divide at the Chicago, Milwaukee, St. Paul and Pacific Railroad bridge (Point 1). Waters may be further divided into the east overflow channel (Point 2). This division of water creates flooding hazards for a large area in the eastern part of the city.

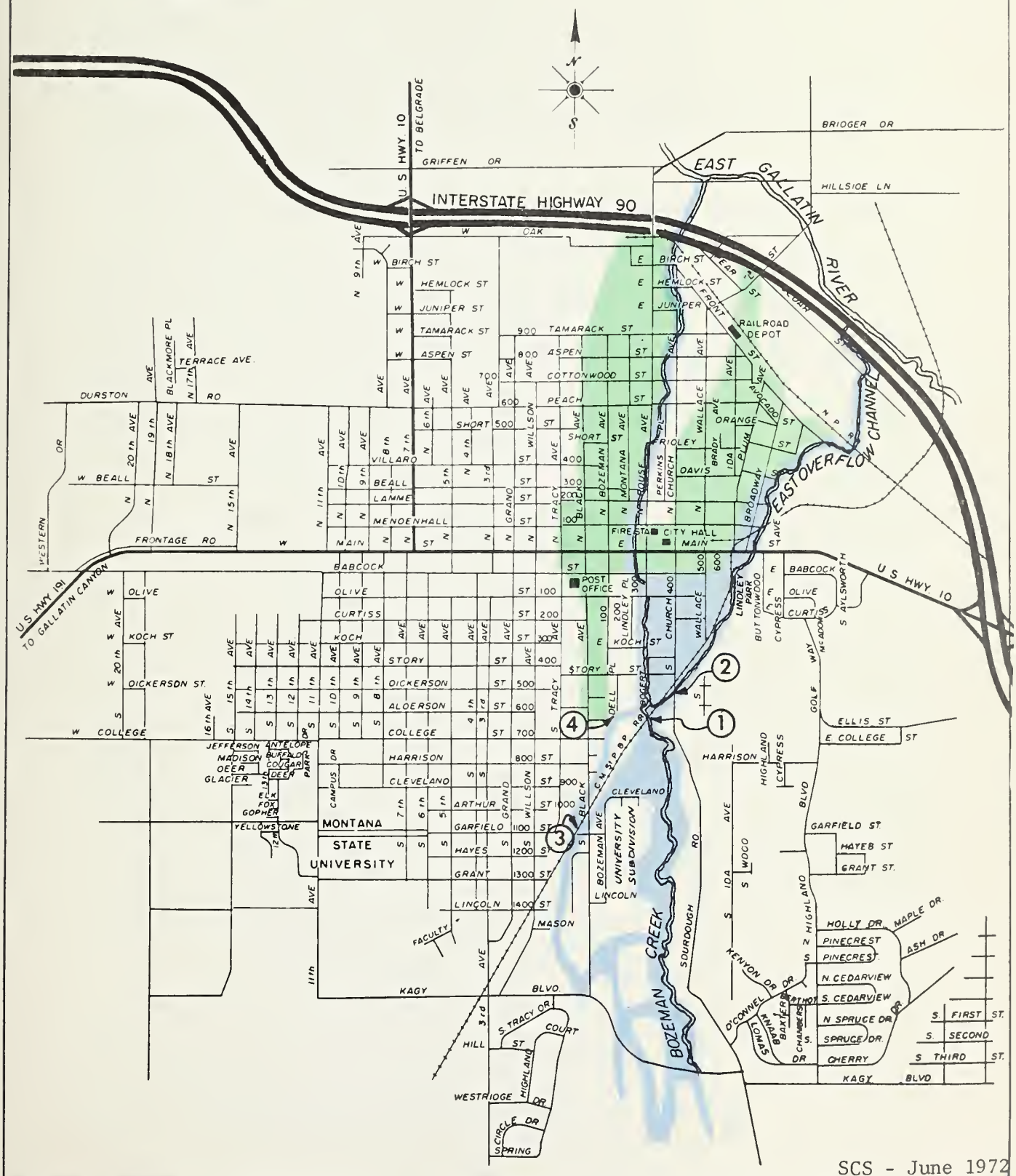
The secondary channel flowing along the west side of the floodplain can overflow at the road crossing on Garfield Street (Point 3) causing flooding in the northern part of University Subdivision. This secondary channel also can overtop the dike at Point 4. This overflow becomes isolated and floods the area on the west side of the main channel.

The green areas on the map are generally limited to shallow flow in the streets. Because of the unpredictable nature of this type of flooding, floodwater elevations in these green areas are not represented by computed water surface elevations shown elsewhere in this report.

Bear Canyon Creek, Rocky Creek, and Bridger Creek are well entrenched and flooding is limited to floodplain areas along the main channels.

The East Gallatin River upstream from the mouth of Bozeman Creek is well entrenched also, with minor flooding restricted to areas near the main channel. As the East Gallatin flows beyond Bozeman Creek, the floodplain widens and becomes less definable. There are many old channels and meanders in the valley floor caused by natural and man-made channel changes. When the river reaches flood stage at approximately

MAP OF BOZEMAN MONTANA



SCS - June 1972

800 cubic feet per second, waters from the main channel overflow into these old channels. This overflow water may run in these old channels for several miles before it rejoins the main channel. This flow causes "islands" or isolated areas in the floodplain. These were impossible to delineate accurately on the small scale floodplain aerial mosaic maps used in this report.

Time and cost considerations limited the amount of detailed topographic information that could be gathered for this report. Therefore, the delineated areas subject to inundation on the mosaic maps are general in nature and may include small areas that do not flood or vice versa.

JUNE 1970 15-YEAR FREQUENCY SCS PHOTO MT-P556-4

Flooding along East Gallatin River. These flood problems were probably not anticipated. Flood hazard studies are intended to help people identify problem areas.

JUNE 1969 5-YEAR FREQUENCY

JUNE 1968 5-YEAR FREQUENCY SCS PHOTO MT-P407-6

Floodwater in 1968 at Riverside Country Club.

MAY 1972 SCS PHOTO MT-P969-6

Areas with a history of flooding, such as the one shown above along the East Gallatin River, are being developed. See same area below under flooded conditions.

APRIL 1971 35-YEAR FREQUENCY SCS PHOTO

Area flooded by a record event. Lesser floods also inundate portions of this area.

JUNE 1969 SCS PHOTO MT-P538-14

Flooding occurs along Bozeman Creek within the city limits of Bozeman. A need exists for urban flood protection measures as well as preventing future development in such hazardous areas.

JUNE 1968 SCS PHOTO MT-P538-11

PLATE 4

MAY 1970 5-YEAR FREQUENCY MT-P658-3

Flooding along Bridger Creek.

MAY 1970 5-YEAR FREQUENCY MT-P666-6

PLATE 5

JUNE 1969 SCS PHOTO

City bridges over the main channel of Bozeman Creek often are used at capacity. Any restriction to flows through these bridges could cause major urban damages even from relatively small runoff events.

MAY 1970 SCS PHOTO MT-P670-6

JUNE 1969 SCS PHOTO MT-P538-10

If upstream channels are combined on the south side of Bozeman, through further urban development, flooding would occur more often. Floodplain management is essential to reduce flood losses and unwise land use in hazardous areas.

PLATE 6

EAST GALLATIN RIVER JUNE 1969 5-YEAR FREQUENCY SCS PHOTO MT-P538-7

BOZEMAN CREEK MAY 1970 SCS PHOTO MT-P671-7

BOZEMAN CREEK MAY 1970 SCS PHOTO MT-P671-5

Roads and bridges often have high maintenance costs when located in vulnerable floodplain areas. Maintenance costs may increase with improper channel modifications and floodway encroachment.

PLATE 7

JUNE 1969 SCS PHOTO

Flooding due to an intense local rainstorm. High water in Bozeman Creek can overflow channel banks in the south part of the city, increasing downtown flood problems.

JUNE 1969 SCS PHOTO

EAST GALLATIN RIVER JUNE 1970 15-YEAR FREQUENCY SCS PHOTO MT-P556-4

People outside the floodplain area suffer inconvenience and economic damage as a result of flooding. Roads and improperly designed channel crossings can increase flood problems.

EAST GALLATIN RIVER MAY 1970

SCS PHOTO MT-P670-12

EAST GALLATIN RIVER JUNE 1969 5-YEAR FREQUENCY SCS PHOTO

PLATE 9

Improperly planned channel measures often contribute to erosion and flooding problems.

JULY 1971 SCS PHOTO MT-P876-4

JULY 1969 SCS PHOTO MT-P581-4

Car bodies used as riprap may create more problems than are solved. Bank erosion may be accelerated and stream channels constricted.

EAST GALLATIN RIVER APRIL 1971 35-YEAR FREQUENCY SCS PHOTO

This gravel dike was not adequate.

JUNE 1970 10-YEAR FREQUENCY MT-P683-3

Floodwater on agricultural land along the East Gallatin River northeast of Belgrade.

Water that overflows main channels often travels several miles in the flood plain in secondary channels before returning to the main stream. Such areas are poor for residential and urban development.

JUNE 1968 MT-P404-3

Flood flows returning to the main channel sometimes cause washouts.

PLATE 11

JUNE 1969 5-YEAR FREQUENCY SCS PHOTO

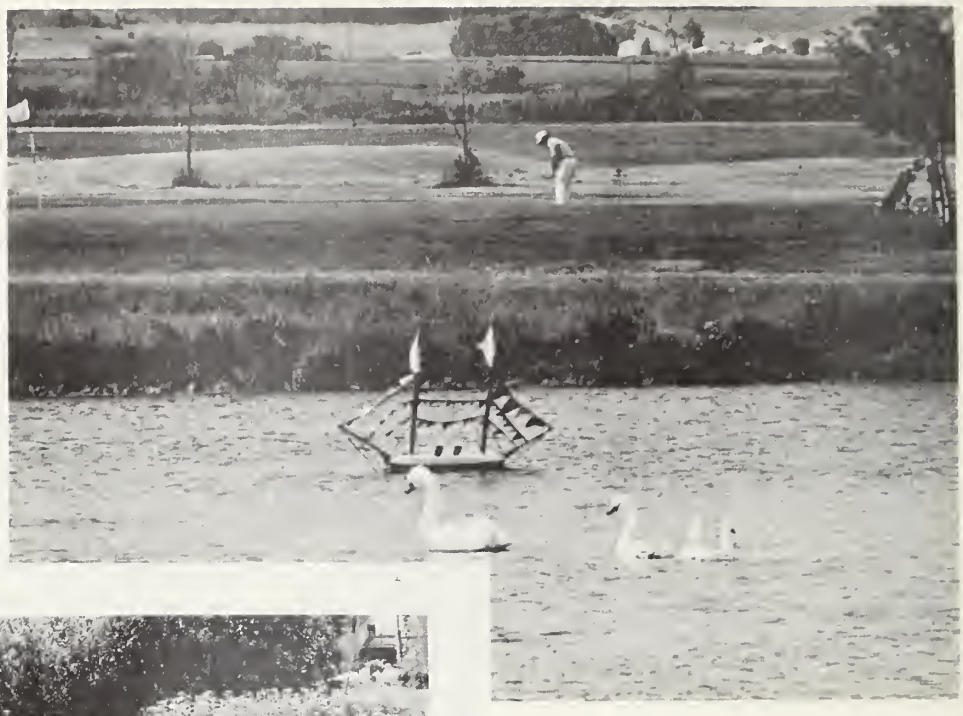
Top photo shows flooding along the East Gallatin River near the confluence with Bozeman Creek. Sheep are trapped on an island.

Photo below shows field damage due to flows in a secondary channel.

Farmers as well as urban people suffer flood damages. In addition to livestock losses, soil and crop damages also occur. Proper flood plain management can reduce losses.

JUNE 1969 MT-P535-10

JUNE 1969 5-YEAR FREQUENCY SCS PHOTO



JULY 1972 SCS PHOTO

JULY 1972 SCS PHOTO

Golf courses and parks are compatible uses for flood prone areas.

JULY 1972 SCS PHOTO

Flood proofing measures such as the gate barrier may be used to protect floodplain property.

STUDY RESULTS AND APPLICATION

The water surface profiles and delineated flood lines are based on existing watershed cover and use and present floodplain and channel conditions. Channel bottoms and high water profiles are shown for the 50-year and 100-year frequency floods on the profile sheets. The approximate area affected by these two selected flood events is shown on the aerial mosaic maps. Because of the topographic relief, the scale of the mosaic maps, and the slight elevation difference between the 50-year and the 100-year frequency flood, the 50-year and the 100-year floods appear as one line.

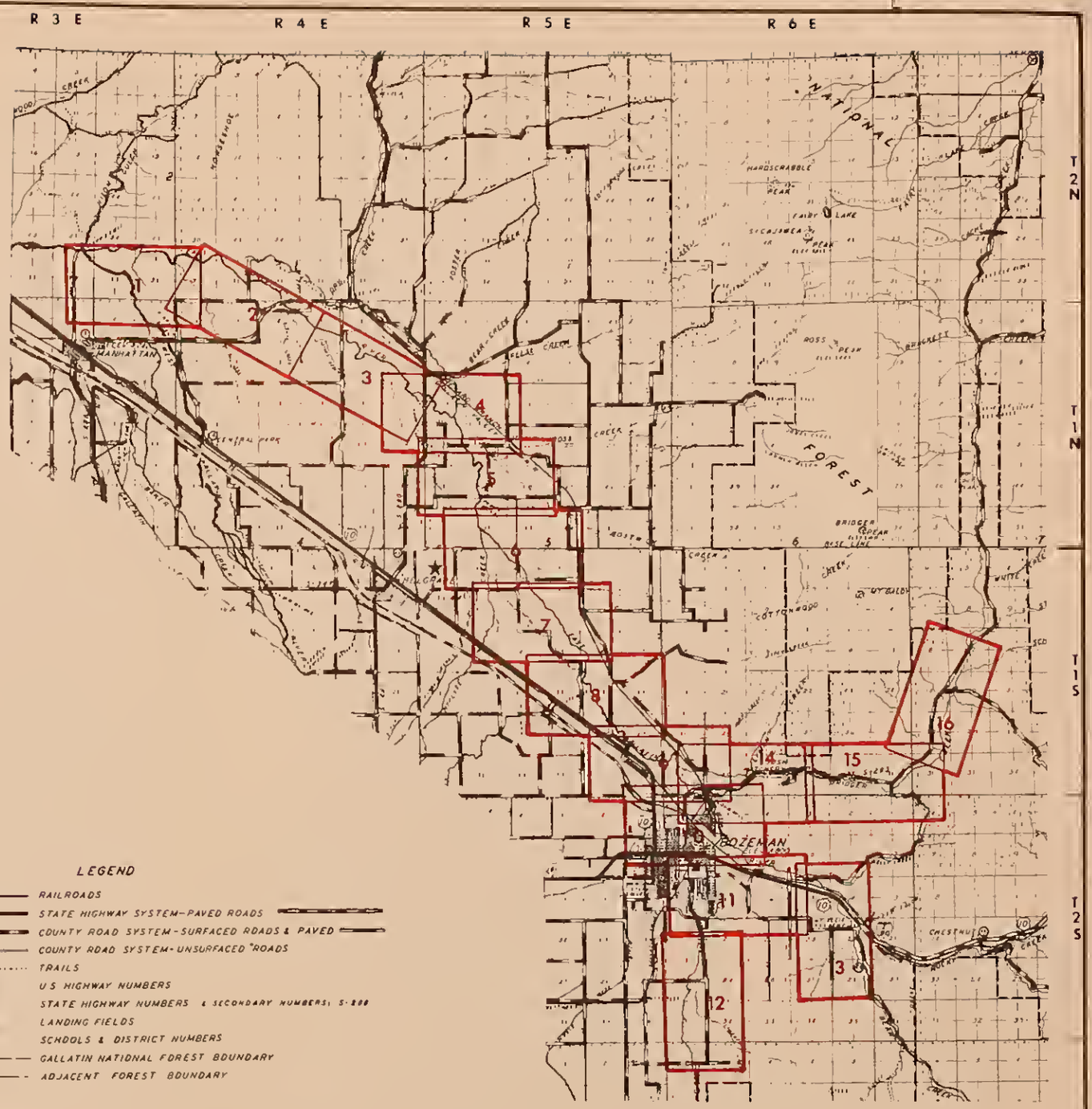
Two different levels of floodwaters are shown on the water surface profiles and tables of elevation below Point 2 through the main portion of Bozeman. See map, page 14. Also see Water Surface Profile drawings and tables. The plotting of two elevations was necessary because floodwaters divide between the main Bozeman Creek channel and east overflow channel and different levels prevail in each one for a given cross-section.

The green shaded area in downtown Bozeman, shown on the map on page 14, can be flooded at depths of one foot or less for any storm exceeding the 25-year frequency or 4-percent chance storm. Flooding in this area is difficult to predict and would depend on overtopping and upstream flows. The location of overtopping depends on the existence of debris and future man-made changes.

For information about the estimated floodwater elevation at a specific location, refer to the aerial mosaic maps to determine where

this location is relative to the nearest upstream and downstream surveyed cross-sections. Interpolation is necessary between cross-sections to arrive at an estimated floodwater elevation from floodplain reference data tables, Appendix B.

Another method to determine a floodwater elevation at a specific location is to estimate the channel station near the location in question from the stations shown on the maps. Then find the location of that station on the profile sheets. Read the flood elevation directly from the sheet by going vertically from the station scale to the plotted floodwater line and then horizontally to read the elevation.



LEGEND

- RAILROADS
- STATE HIGHWAY SYSTEM-PAVED ROADS
- COUNTY ROAD SYSTEM-SURFACED ROADS & PAVED
- COUNTY ROAD SYSTEM-UNSURFACED ROADS
- TRAILS
- U.S HIGHWAY NUMBERS
- STATE HIGHWAY NUMBERS & SECONDARY NUMBERS; S-888
- LANDING FIELDS
- SCHOOLS & DISTRICT NUMBERS
- GALLATIN NATIONAL FOREST BOUNDARY
- ADJACENT FOREST BOUNDARY

Sheet Coverage

N

NOTE:
MOSAIC SHEETS ARE BASED ON 1965 AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE AERIAL PHOTOGRAPHS

SCALE OF MILES

AERIAL MOSAIC MAP INDEX
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY, 1972

R3E|R4E

370 END OF STUDY

369

368

EAST GALLATIN RIVER

WEST GALLATIN RIVER

MATCH SHEET 2

T1N|T2N

SALES ROAD

SCALE 1000 500 0 1000 2000 3000 FEET

APPROXIMATE

N

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

SOILS AREA BOUNDARY AND SYMBOL

(331) VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

R3E|R4E

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 1 OF 16

R3E\R4E

T2N/T1N

EAST GALLATIN RIVER

OLD BRIDGER CREEK ROAD

SALES ROAD

MATCH SHEET 1

MATCH SHEET 3

TIN\T2N

R3E\R4E

SCALE 1000 500 0 1000 2000 3000 FEET

APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

H SOILS AREA BOUNDARY AND SYMBOL

331 VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 2 OF 16

R4E \ R5E

SMITH CREEK

SMITH RIVER

GALLATIN

EAST GALLATIN

MATCH SHEET 4

MATCH SHEET 3

TIN

R4E / R5E

SCALE 1000 500 0 1000 2000 3000 FEET

APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

SOILS AREA BOUNDARY AND SYMBOL

VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 3 OF 16

R4E R5E

T1N

SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
C SOILS AREA BOUNDARY AND SYMBOL
331 VALLEY SECTION

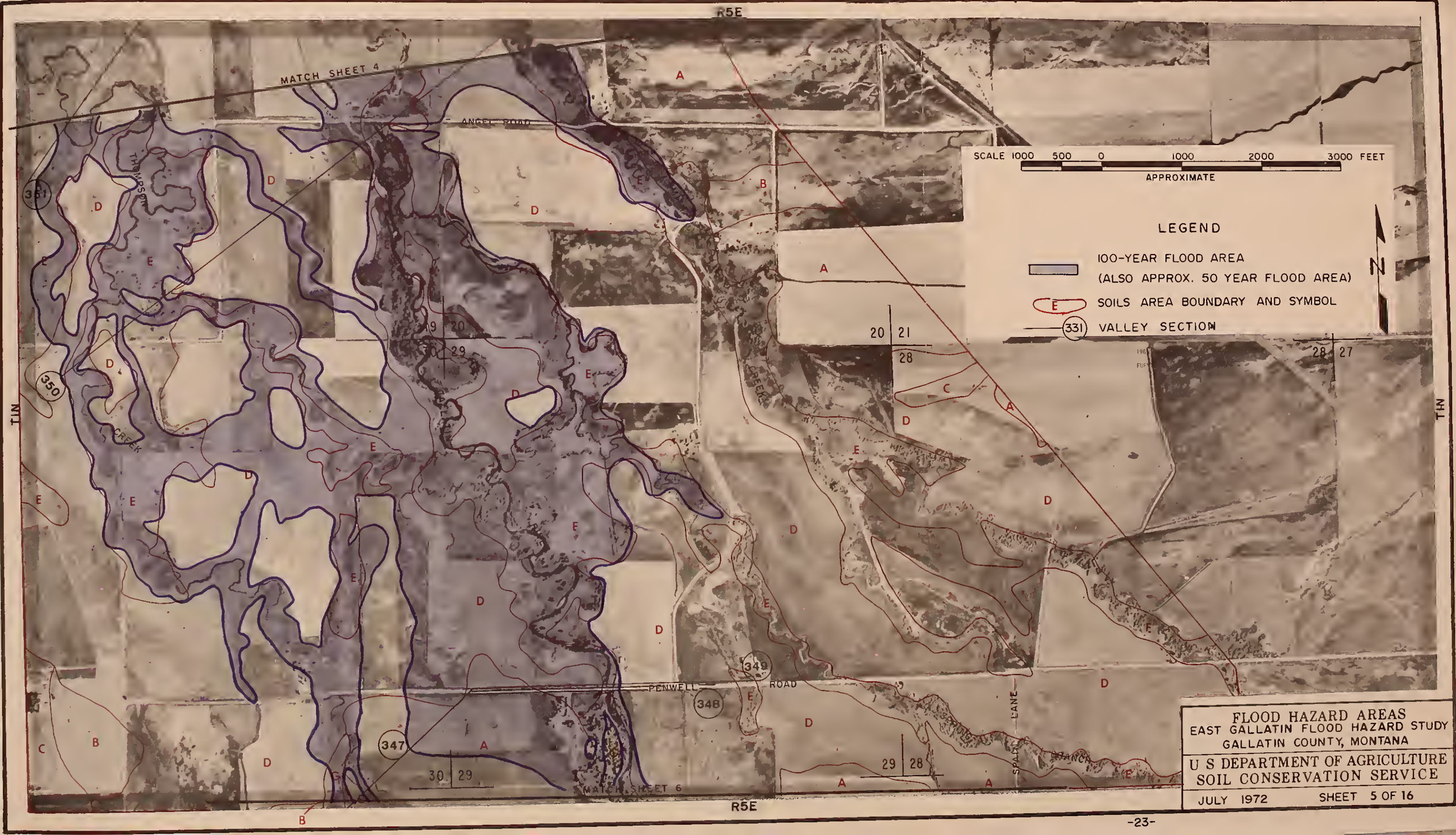
1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

MATCH SHEET 5

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

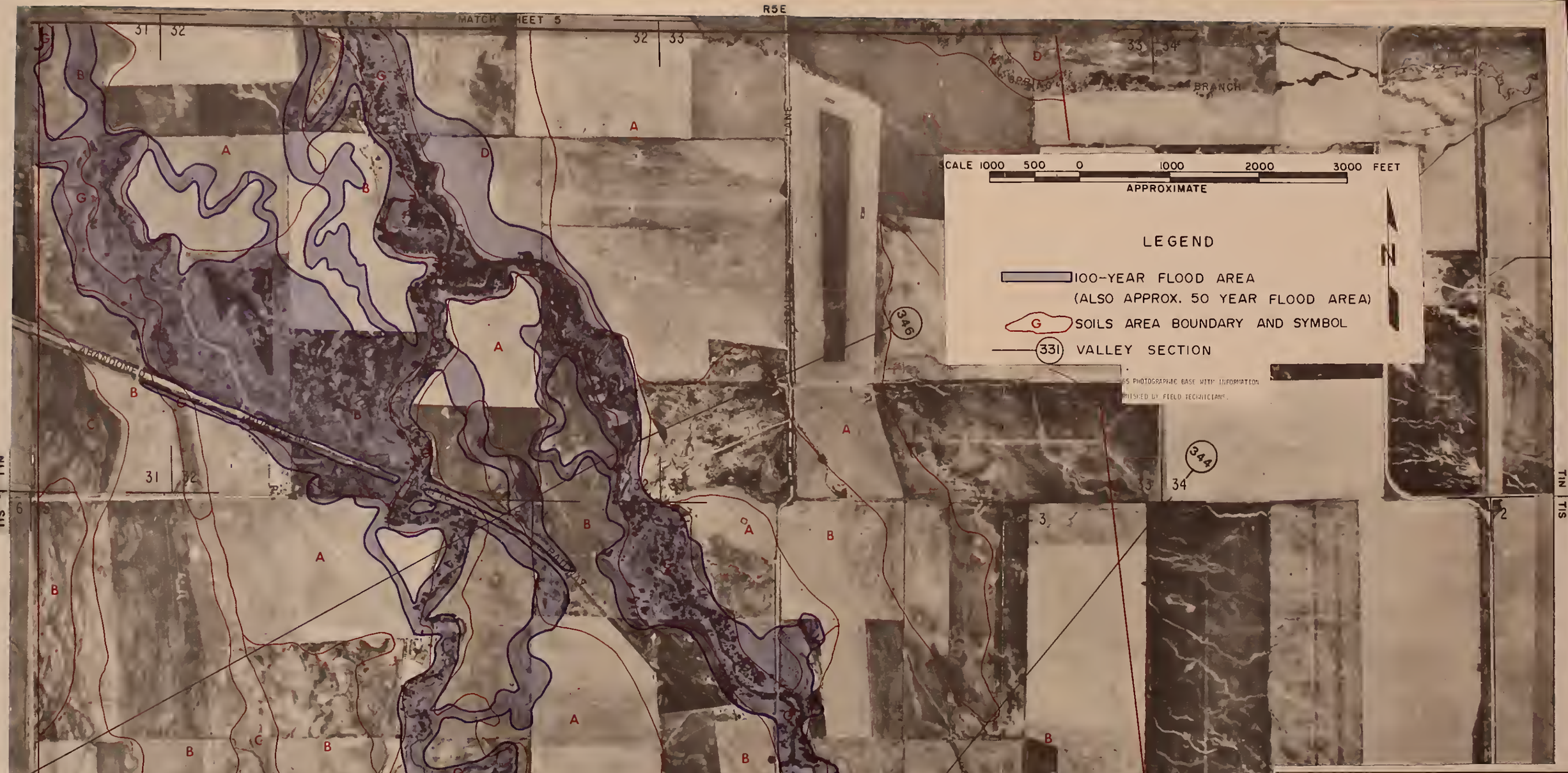
JULY 1972 . SHEET 4 OF 16



FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

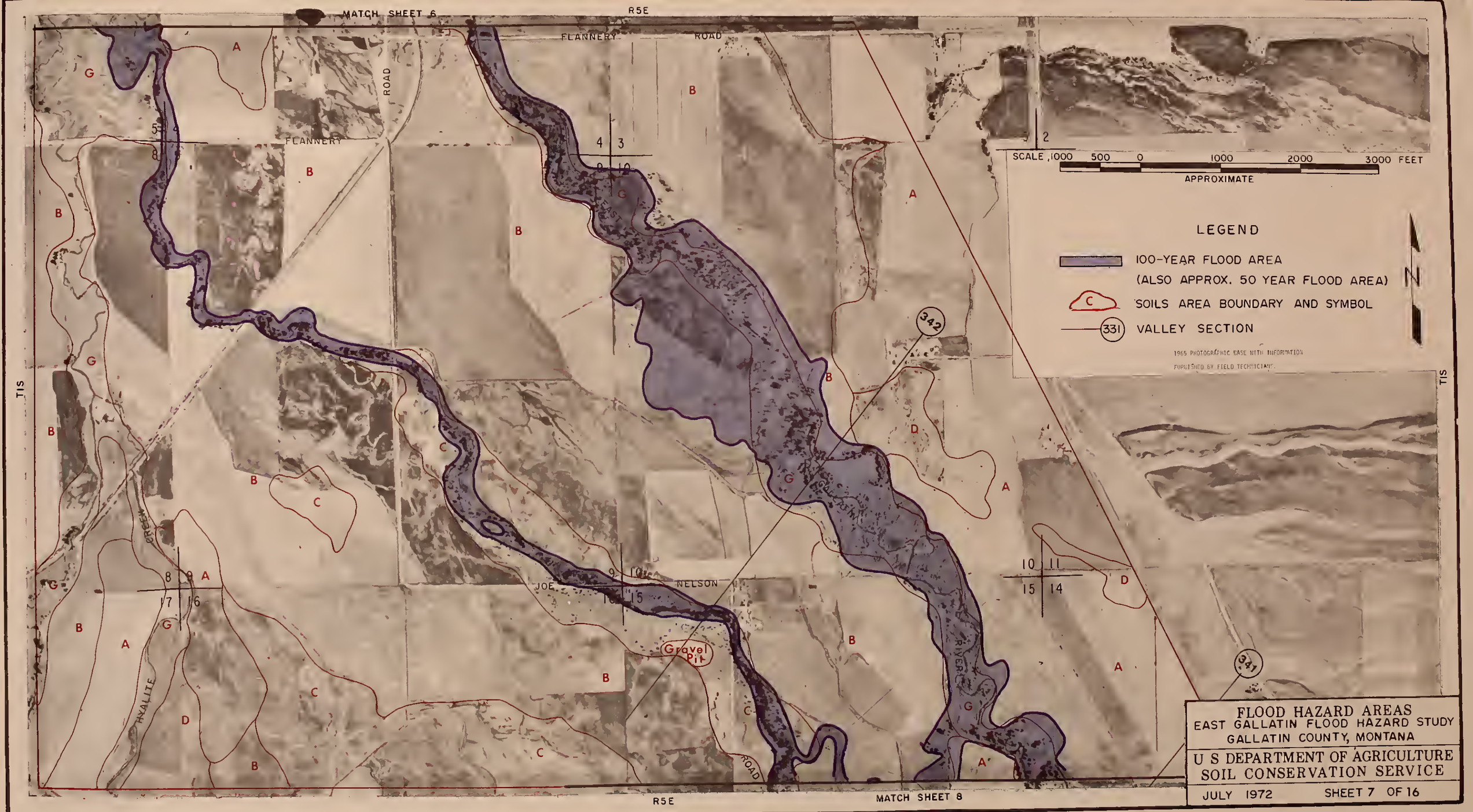
JULY 1972 SHEET 5 OF 16

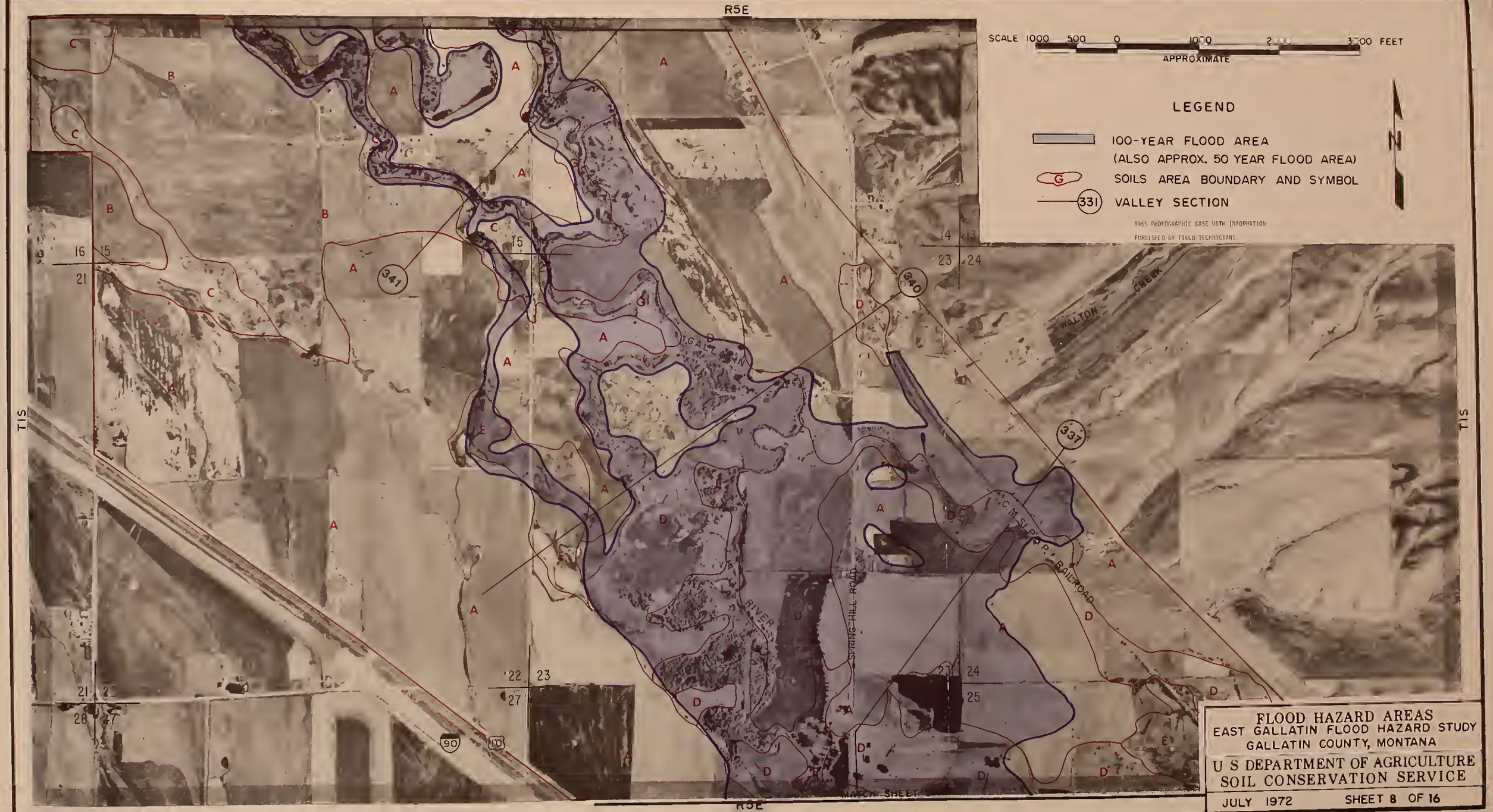


FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

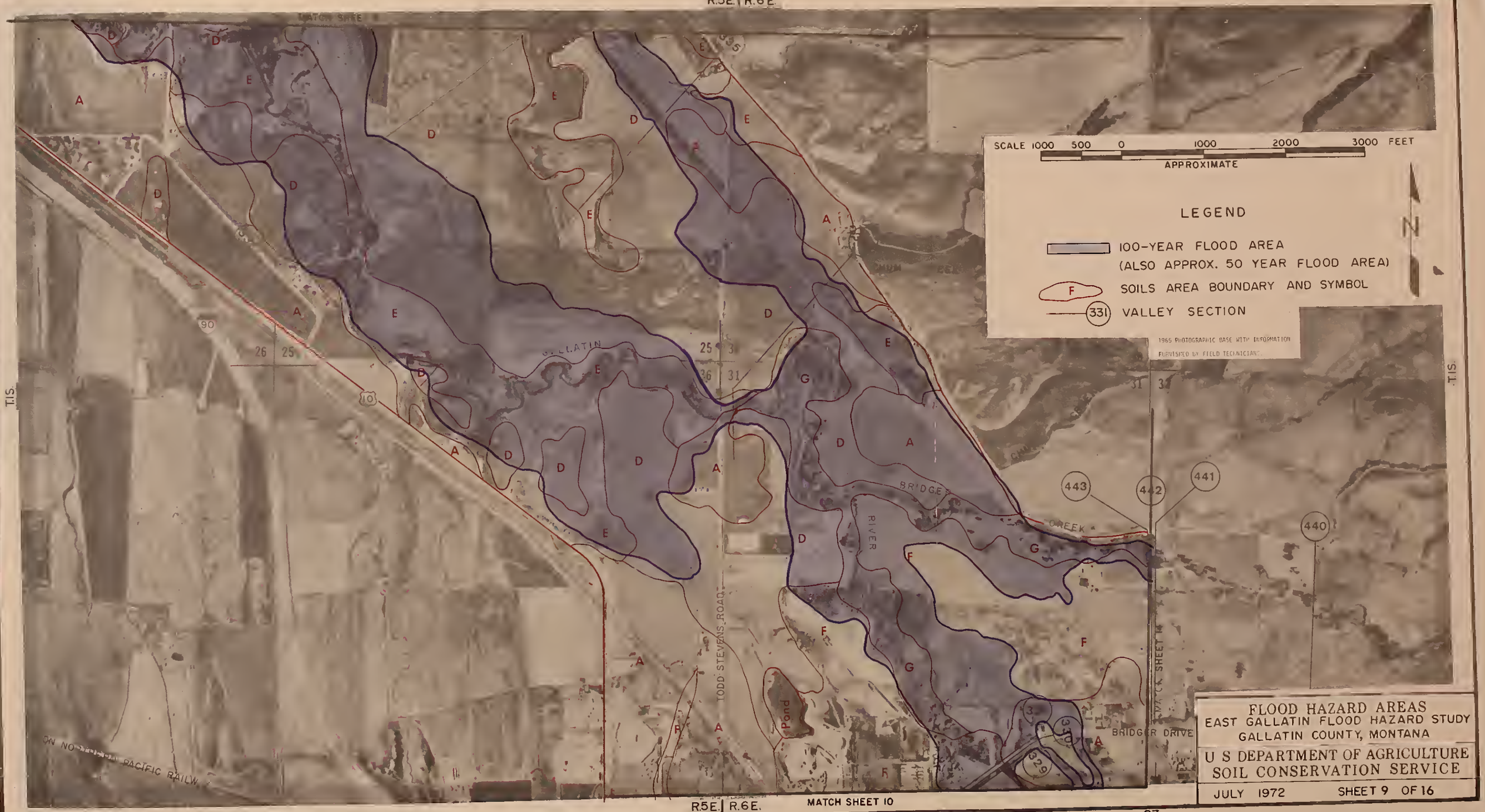
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 6 OF 16


MATCH SHEET 6
R5E
FLANNERY ROAD
FLANNERY ROAD
EAST GALLATIN
NELSON
JOE
Gravel Pit
HALITE CREEK
RIVER
ROAD
T1S
T1S
R5E
MATCH SHEET 8
342
331
341
SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE
LEGEND
100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
SOILS AREA BOUNDARY AND SYMBOL
VALLEY SECTION
1965 PHOTOGRAPHIC BASE WITH INFORMATION
FURNISHED BY FIELD TECHNICIANS
FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JULY 1972
SHEET 7 OF 16


R5E
T1S
SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE
LEGEND
100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
SOILS AREA BOUNDARY AND SYMBOL
331 VALLEY SECTION
1965 PHOTOGRAPHIC BASE WITH INFORMATION
FURNISHED BY FIELD TECHNICIANS.
N
341
340
337
90
10
GALLATIN RIVER
SPRING HILL ROAD
C.M.St.P.P. RAILROAD
WALTON CREEK
MATCH SHEET
FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JULY 1972
SHEET 8 OF 16

R.5E. | R.6E.

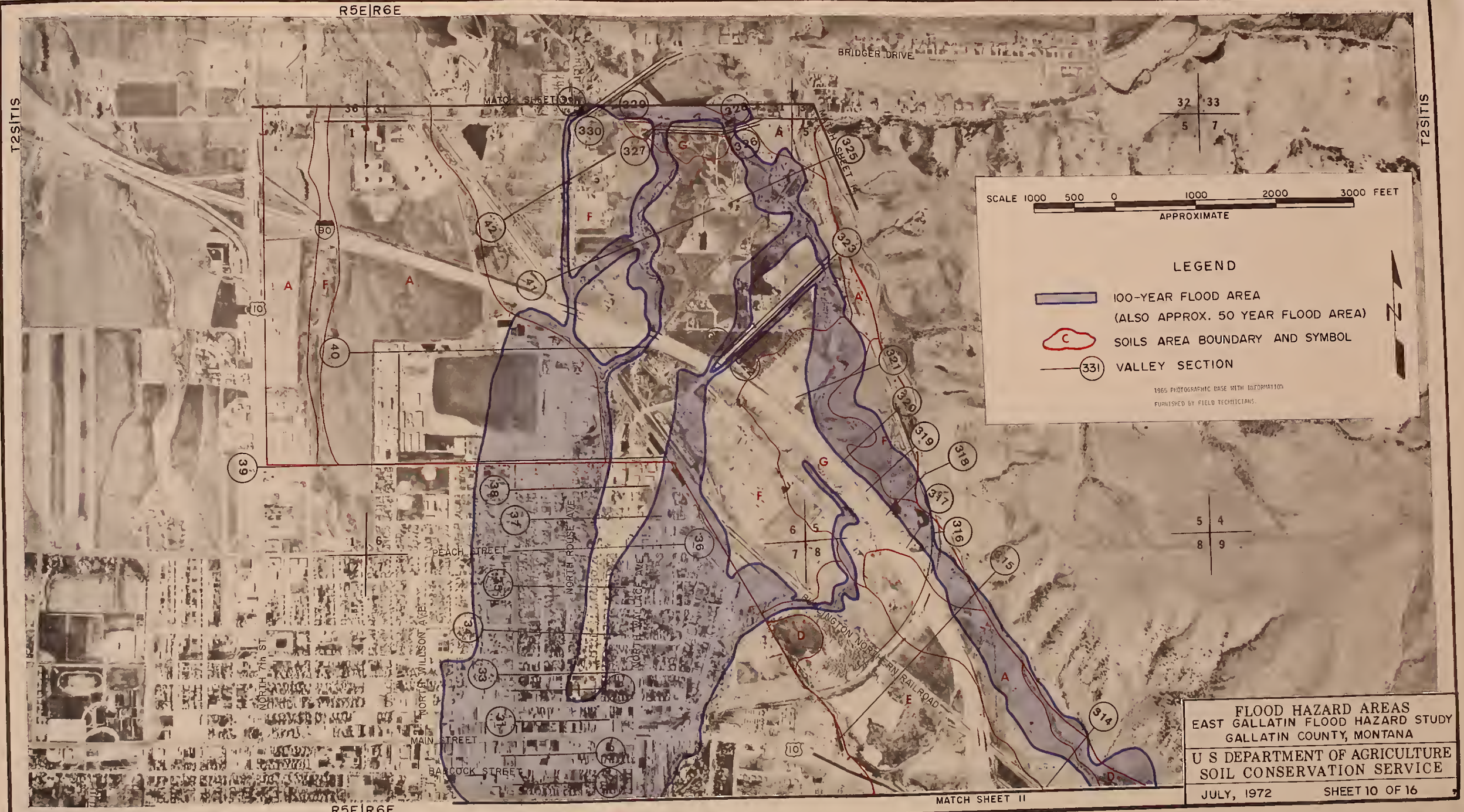


FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 9 OF 16

R.5E. | R.6E. MATCH SHEET 10


R5E|R6E
T2S|T1S
BRIDGER DRIVE
MATCH SHEET 10
MATCH SHEET 11
SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE
LEGEND
100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
SOILS AREA BOUNDARY AND SYMBOL
VALLEY SECTION
1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.
PEACH STREET
NORTH ROUSE AVE
NORTH WALLACE AVE
NORTH WILLSON AVE
NORTH 7th ST
MAIN STREET
BABCOCK STREET
BURLINGTON NORTHERN RAILROAD
FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JULY, 1972
SHEET 10 OF 16

R6E

MATCH SHEET 10

T2S

SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

SOILS AREA BOUNDARY AND SYMBOL

331 VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

N

KAGY

COMBOUR ROAD

LANE

MATCH SHEET 12

R6E

T2S

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY, 1972 SHEET 11 OF 16

T2N | T3N

SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE

N

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
C SOILS AREA BOUNDARY AND SYMBOL
331 VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

SOURDOUGH ROAD
BOZEMAN
GOLDENSTEIN ROAD
SPRING CREEK
CREEK
SCHOOL ROAD
LEVERICH
STUDY AREA LIMIT
SO. 3rd AVE.
MATCH SHEET 11
R5E | R6E

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 12 OF 16

T2S

R6E

R6E

STUDY AREA LIMIT

STUDY AREA LIMIT

KELLY CANYON CUTOFF ROAD

KELLY CANYON

ROCK CREEK

BEAR CANYON CREEK

MT. ELLIS ACADEMY

ACADEMY ROAD

MATCH SHEET II

SCALE 1000 500 0 1000 2000 3000 FEET

APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

SOILS AREA BOUNDARY AND SYMBOL

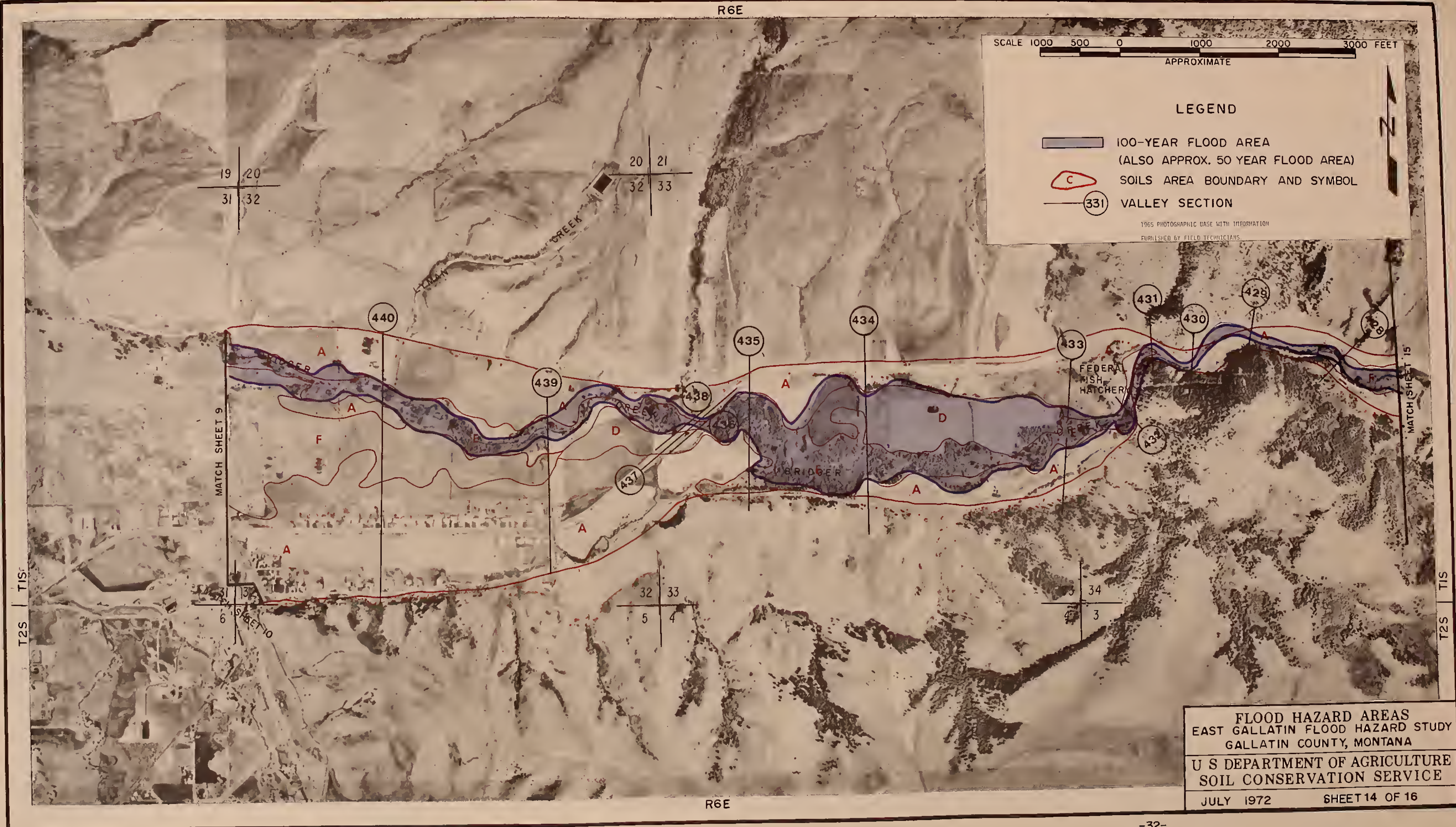
VALLEY SECTION

1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 13 OF 16


R6E
SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE
LEGEND
100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
SOILS AREA BOUNDARY AND SYMBOL
VALLEY SECTION
1965 PHOTOGRAPHIC BASE WITH INFORMATION
FURNISHED BY FIELD TECHNICIANS
N
LYMAN CREEK
BRIDGER CREEK
FEDERAL FISH HATCHERY
MATCH SHEET 9
MATCH SHEET 10
MATCH SHEET 15
T1S
T2S
R6E
FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JULY 1972
SHEET 14 OF 16

R6E R7E

MATCH SHEET 16

MAYFIELD

GREEK

BRIDGER

LOWER BRIDGER SCHOOL

MATCH SHEET 14

T2S T1S

T2S T1S

SCALE 1000 500 0 1000 2000 3000 FEET

APPROXIMATE

LEGEND

100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)

C SOILS AREA BOUNDARY AND SYMBOL

331 VALLEY SECTION

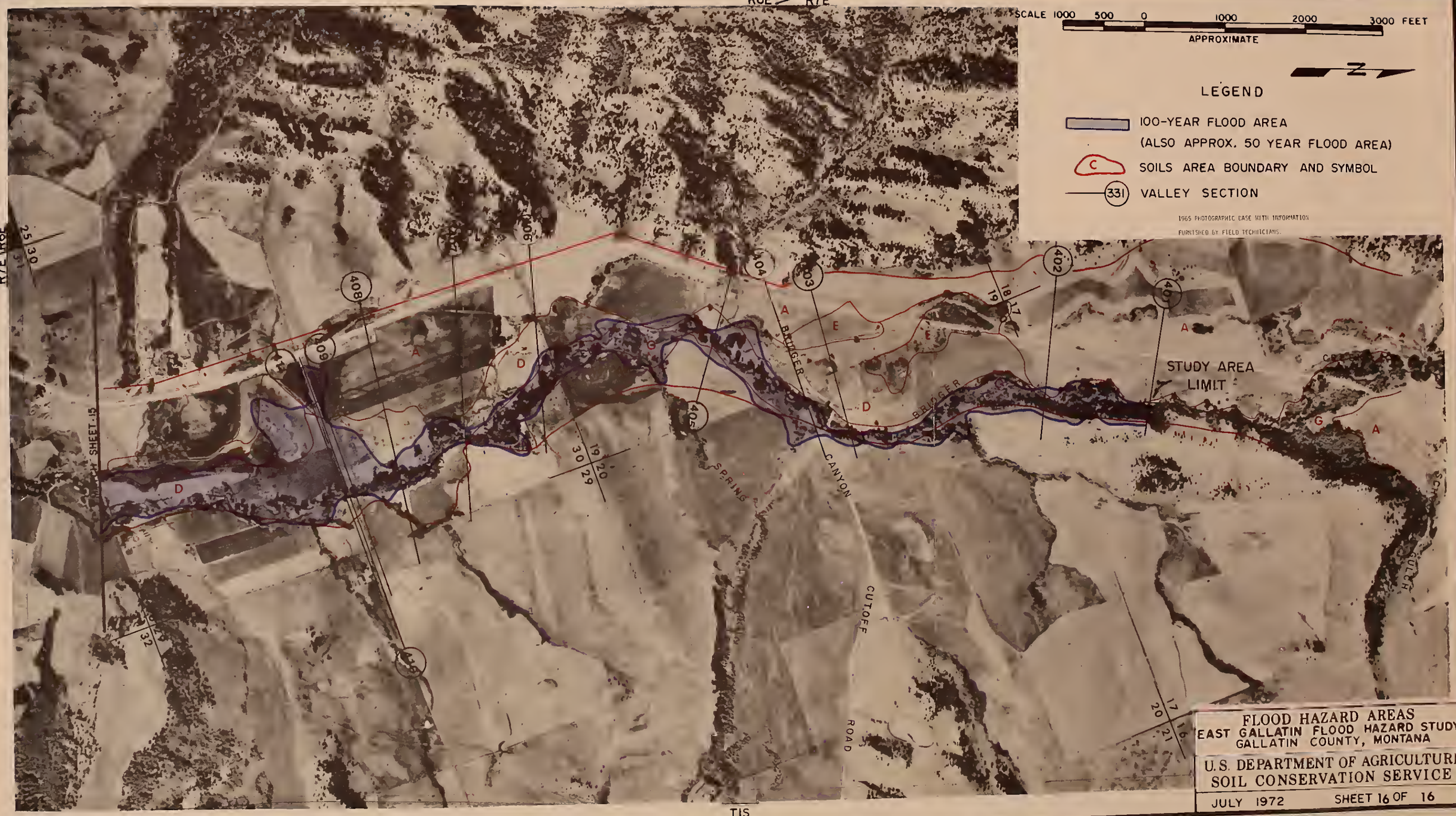
1965 PHOTOGRAPHIC BASE WITH INFORMATION FURNISHED BY FIELD TECHNICIANS.

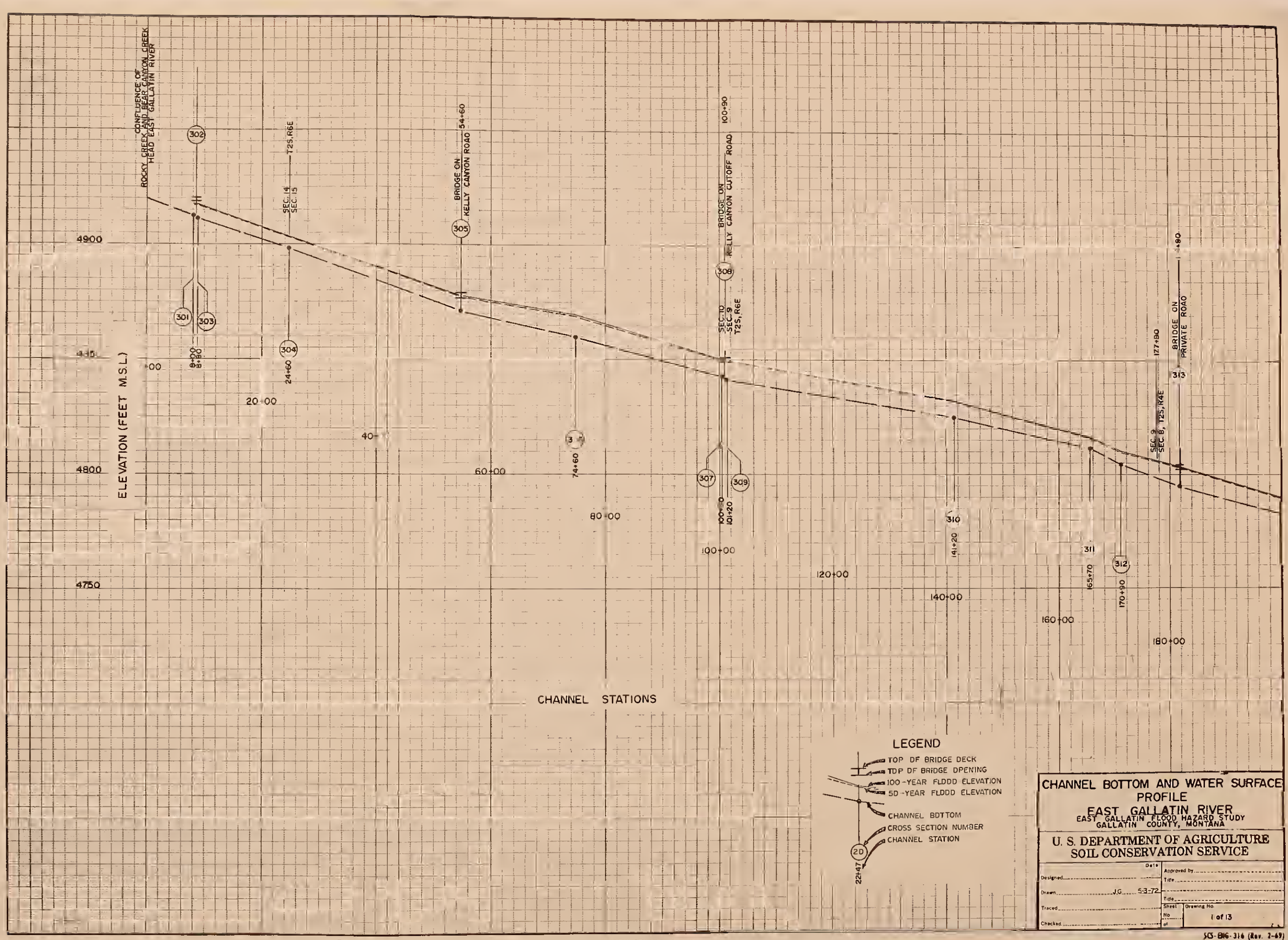
N

FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

JULY 1972 SHEET 15 OF 16


R6E
R7E
SCALE 1000 500 0 1000 2000 3000 FEET
APPROXIMATE
N
LEGEND
100-YEAR FLOOD AREA
(ALSO APPROX. 50 YEAR FLOOD AREA)
C
SOILS AREA BOUNDARY AND SYMBOL
331
VALLEY SECTION
1965 PHOTOGRAPHIC BASE WITH INFORMATION
FURNISHED BY FIELD TECHNICIANS.
R7E
R6E
SHEET 15
STUDY AREA
LIMIT
BRIDGER
CANYON
SPRING
CUTOFF
ROAD
HARDY
SCHOOL
TIS
FLOOD HAZARD AREAS
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
JULY 1972
SHEET 16 OF 16

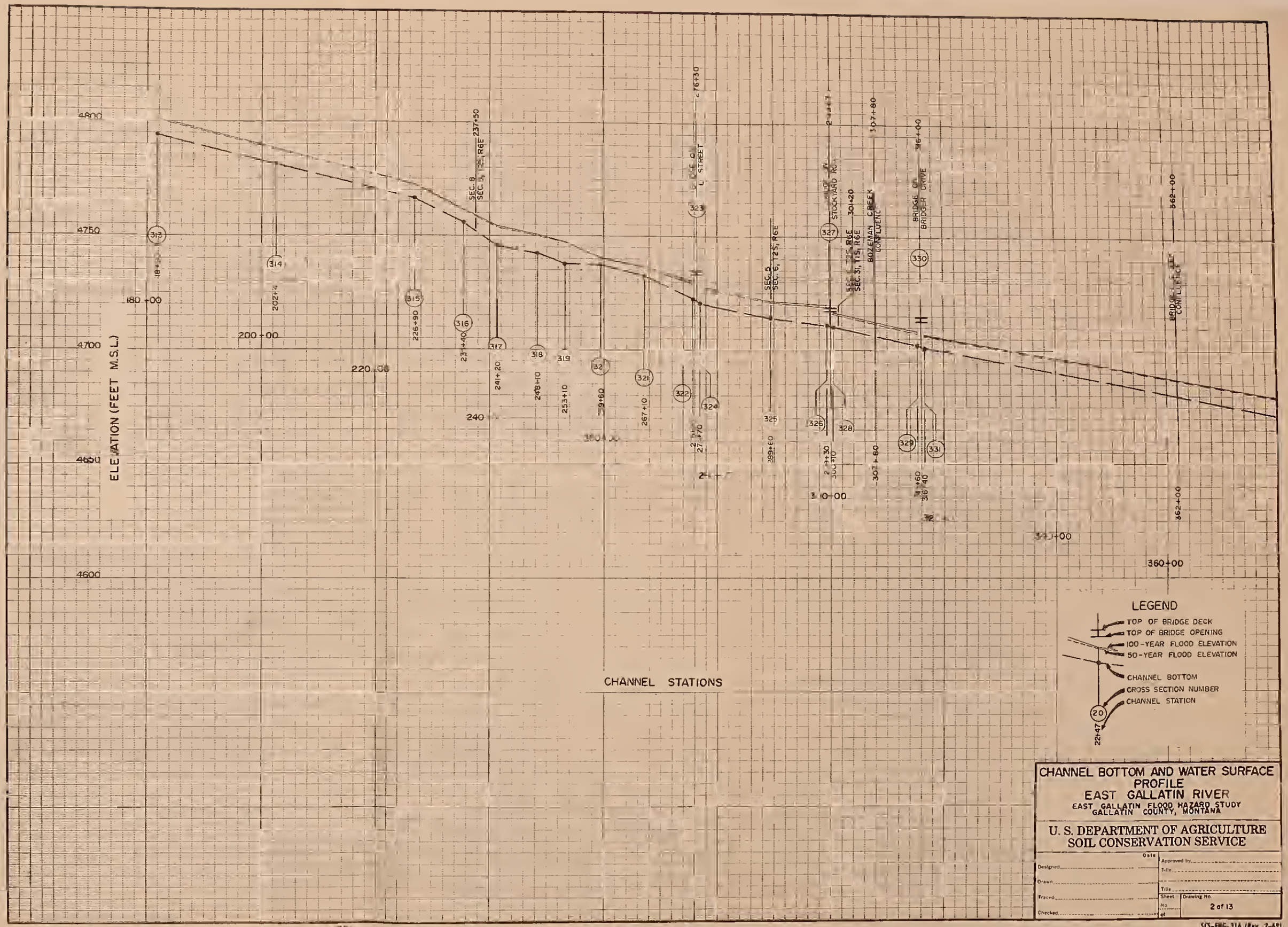


CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn	J.C. 5-3-72	Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 1 of 13

SCS-ENG-316 (Rev. 2-69)



CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date	Approved by
Designed	Title
Drawn	Title
Traced	Sheet No. 2 of 13
Checked	Drawing No.

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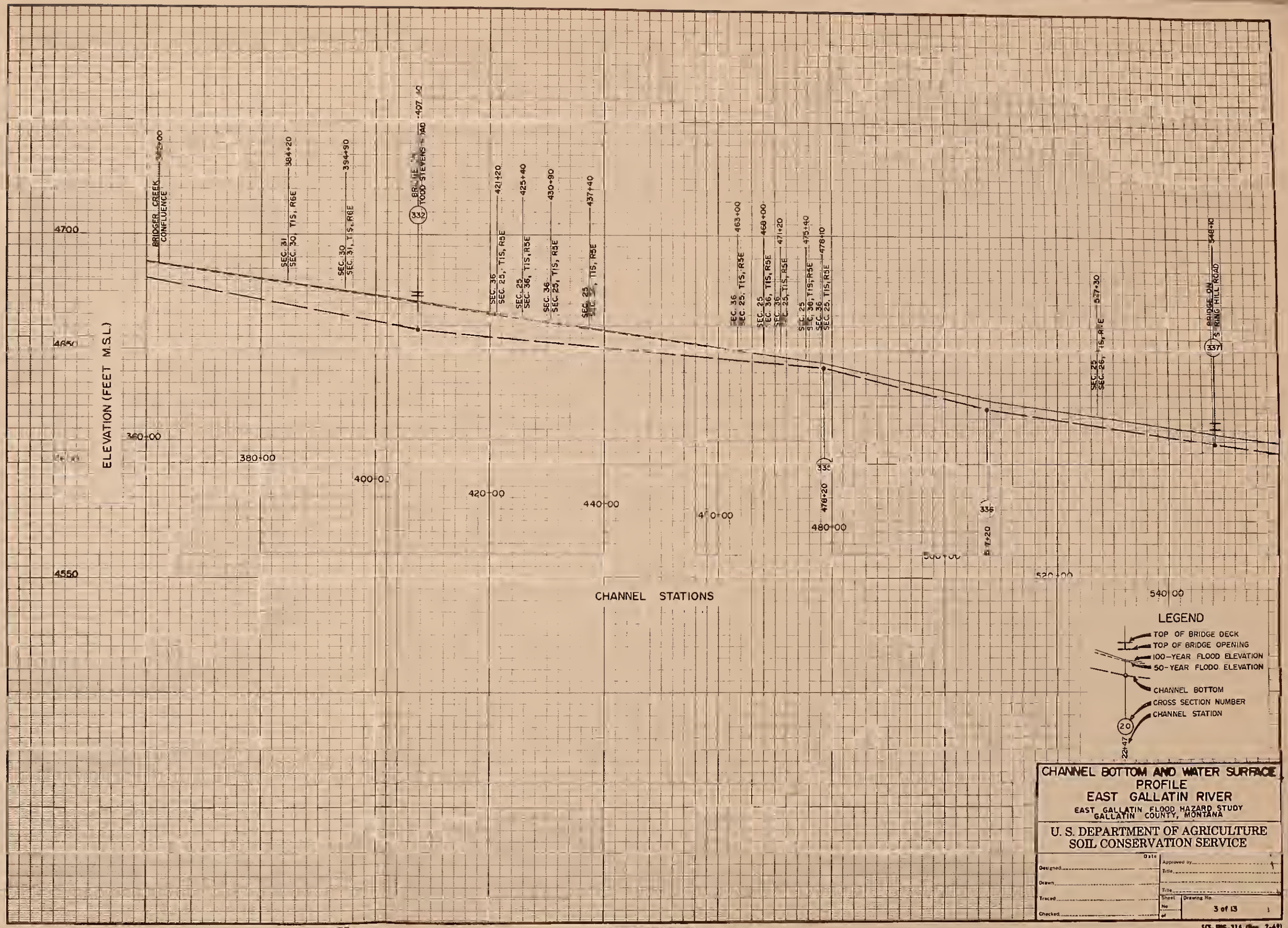

CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Checked		of	

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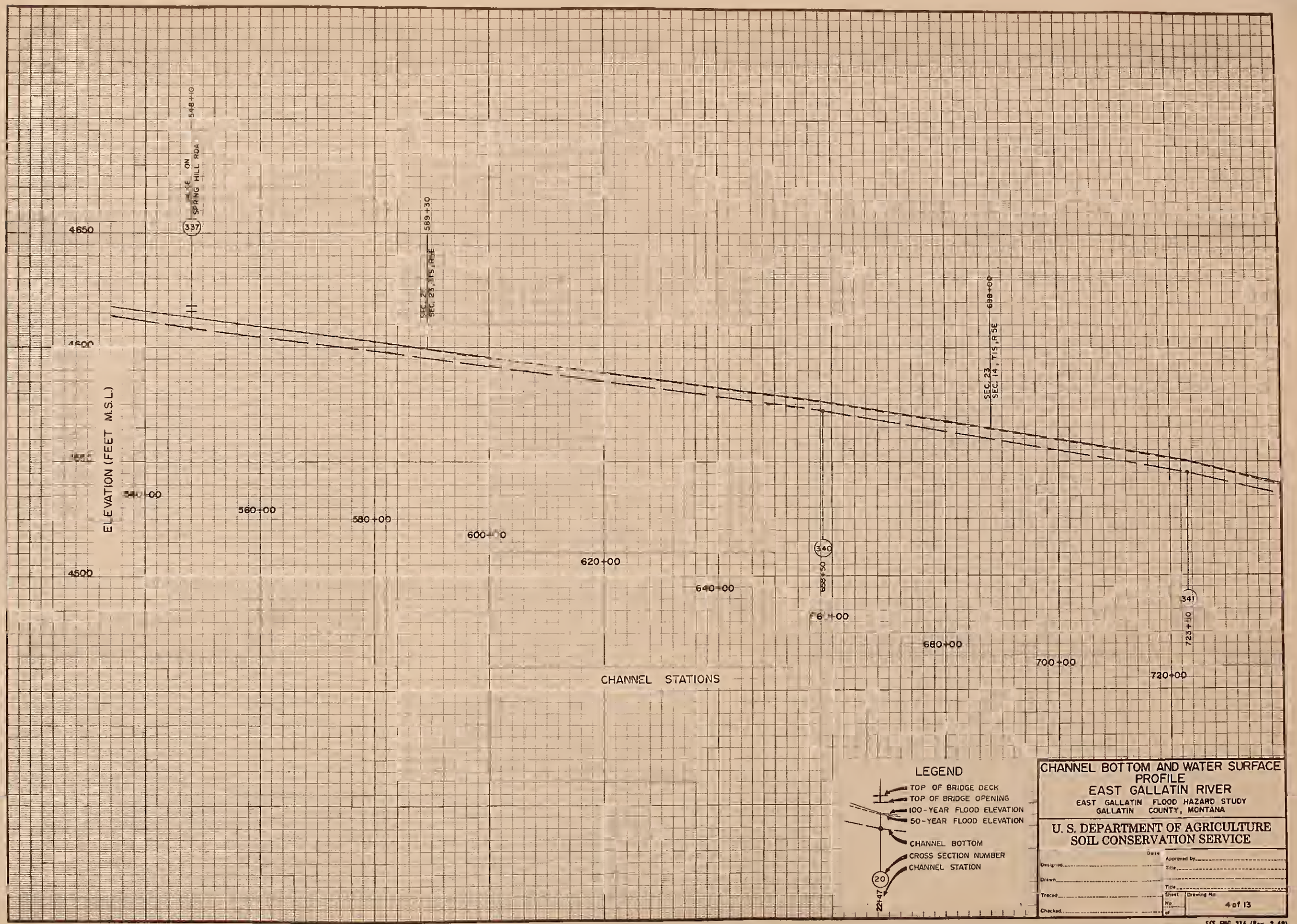

CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
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Drawn — Title
Traced — Title
Checked — Sheet No. 4 of 13 — Drawing No.

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ELEVATION (FEET M.S.L.)

4550

4500

4450

720+00

740+00

760+00

780+00

800+00

820+00

840+00

860+00

880+00

900+00

SEC 14
SEC 15, T 5, R5E

SEC 15
SEC 10, T 1 , R5E

SEC 1
SEC 6, T 1 S, R6E

SEC 6, T 1 S, R6E
SEC 9, T 1 S, R5E

723+

781+60

809+30

879

885+50

41

342

343

CHANNEL STATIONS

LEGEND

TOP OF BRIDGE DECK
TOP OF BRIDGE OPENING
100-YEAR FLOOD ELEVATION
50-YEAR FLOOD ELEVATION
CHANNEL BOTTOM
CROSS SECTION NUMBER
CHANNEL STATION

20

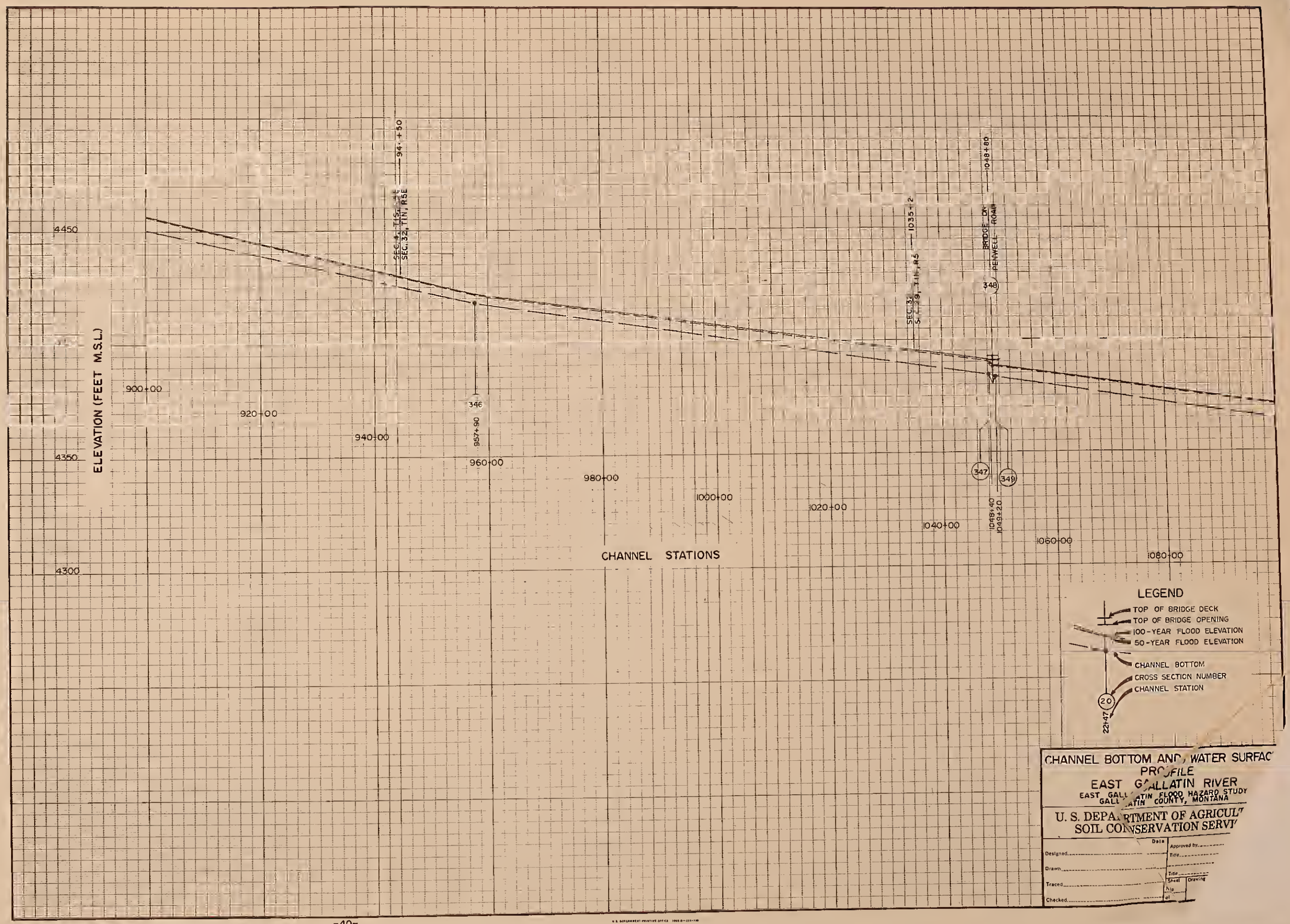
224+

CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn		Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 6 of 13

SCS ENG 376 (Rev. 2-69)



CHANNEL BOTTOM AND WATER SURFACE PROFILE

EAST GALLATIN RIVER

EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
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Traced		Sheet No.	Drawing No.
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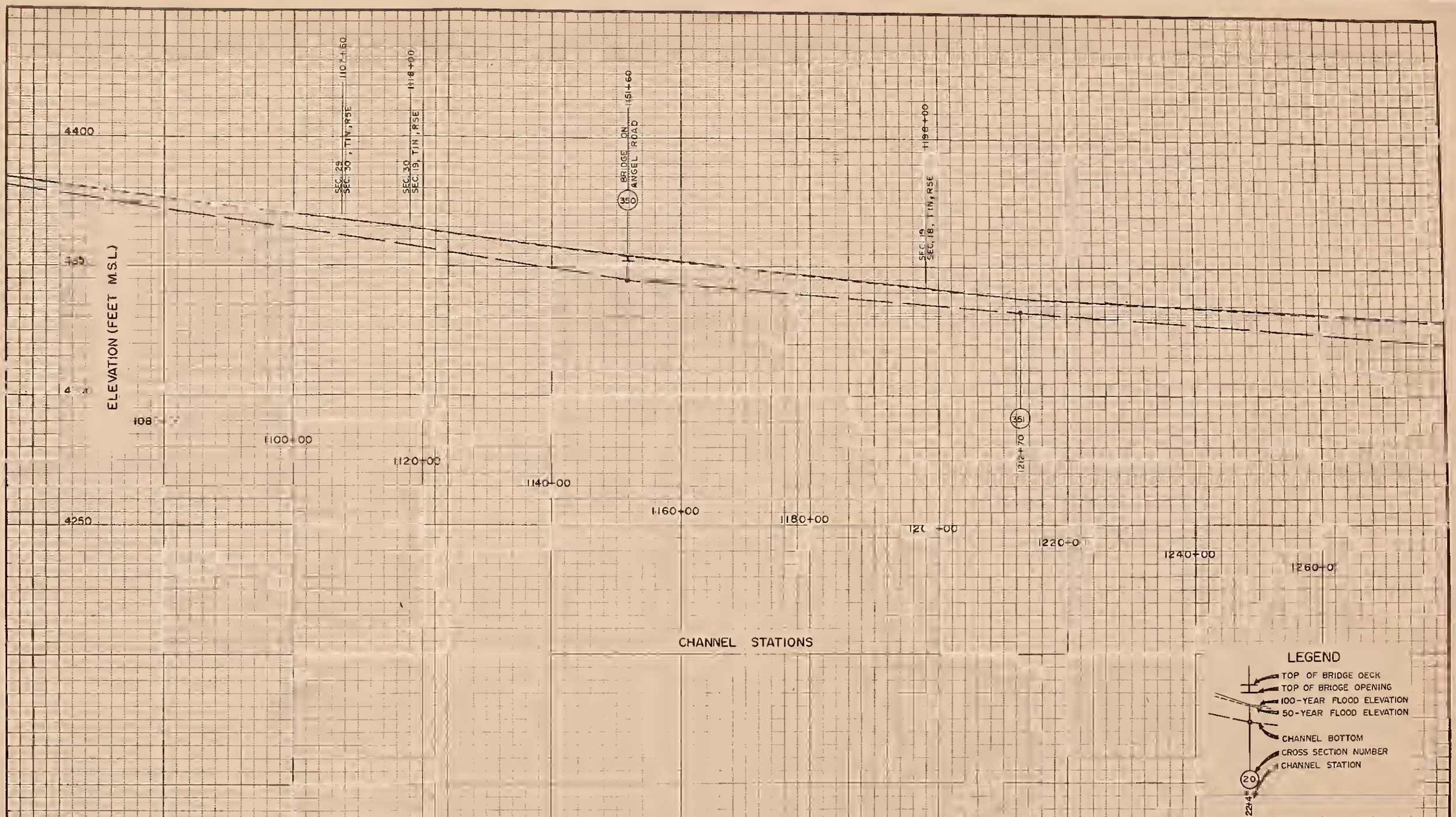
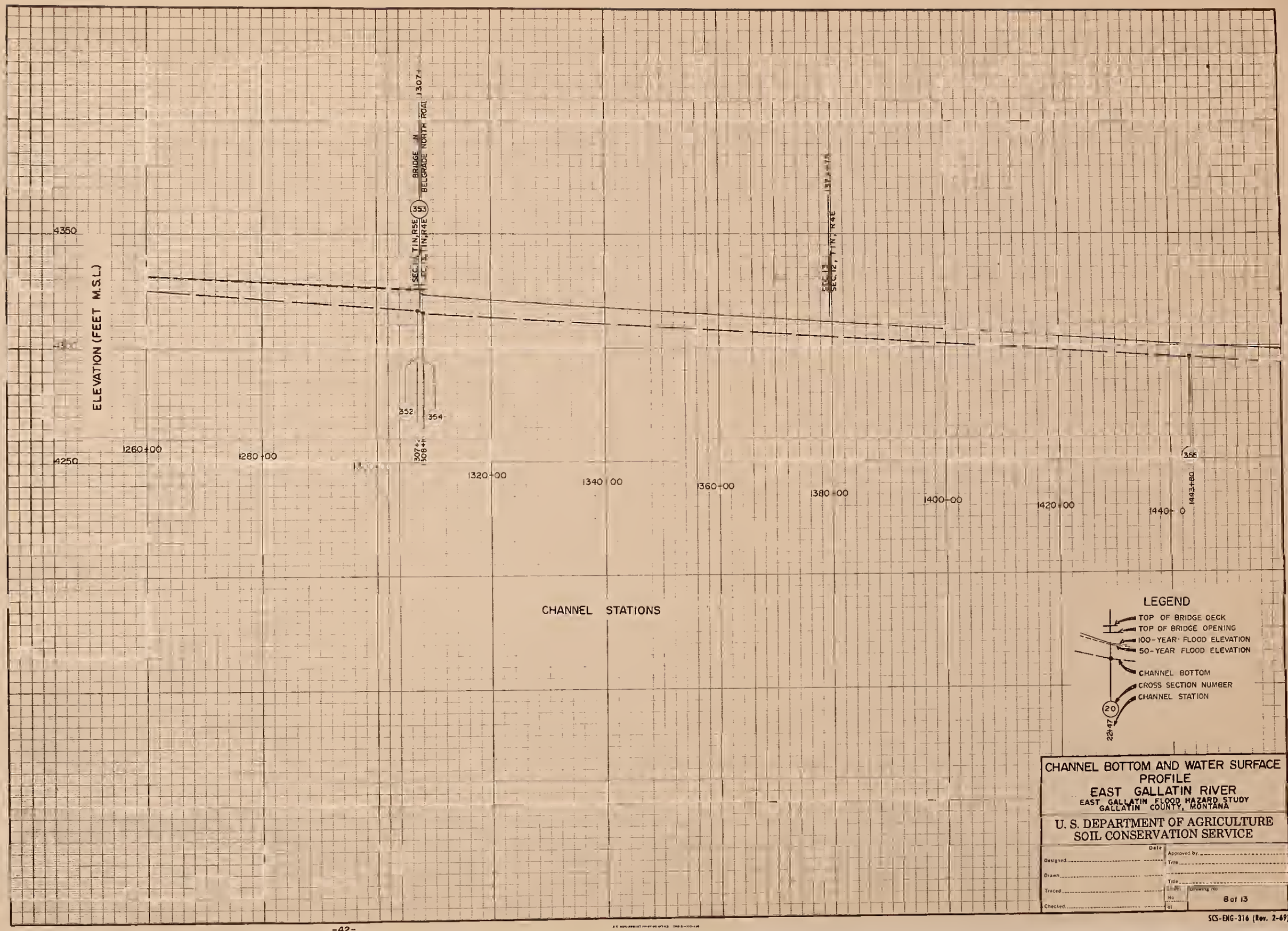


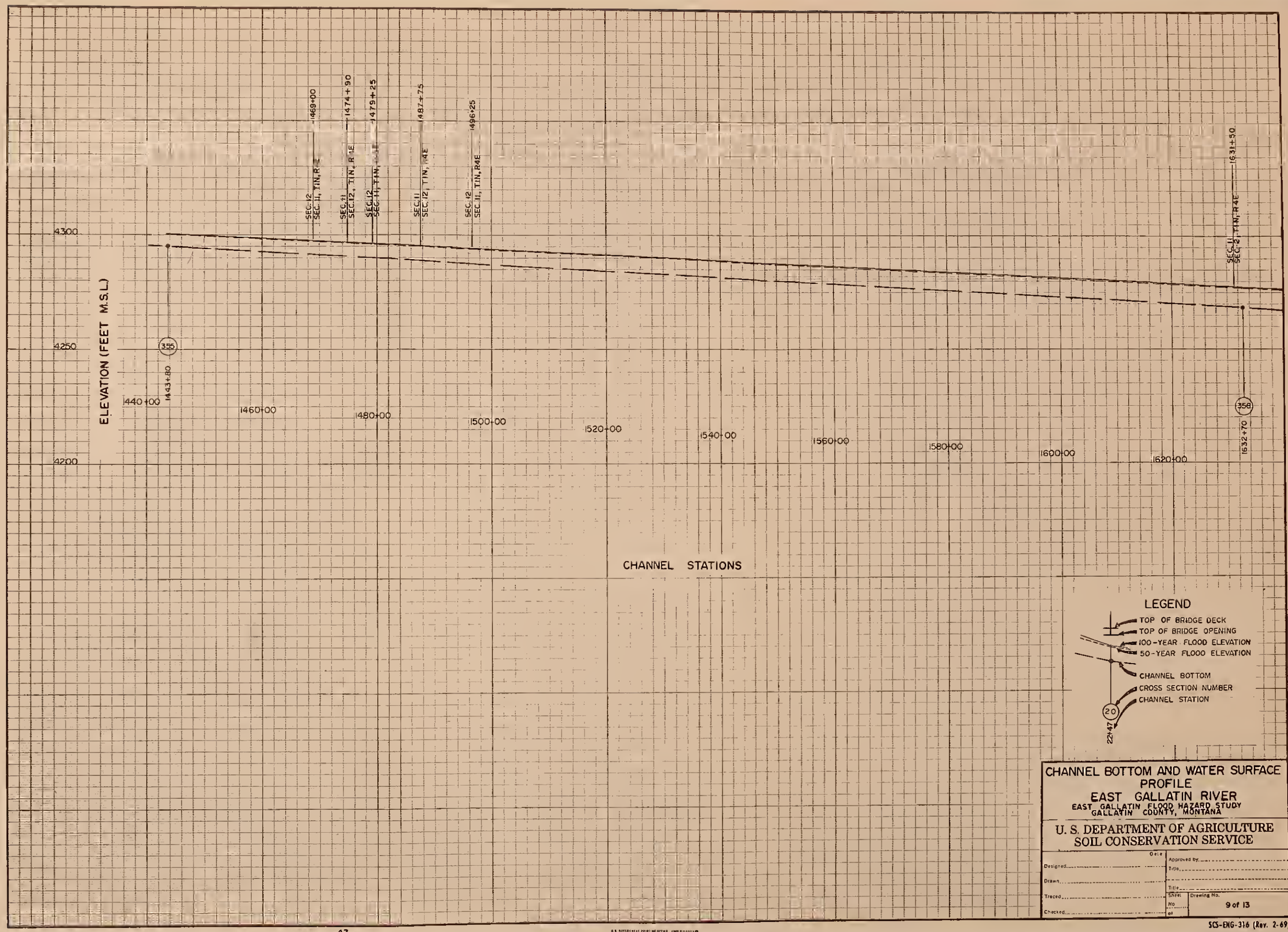
CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved By	
Drawn		Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 7 of 13

SCS-ENG-316 (Rev. 2-69)


ELEVATION (FEET M.S.L.)
4350
4250
SEC. 13, T 1N, R 4E
SEC. 12, T 1N, R 4E
BRIDGE NO. 35
BELGRADE NORTH ROAD
1307+
352
354
307+
308+
1260+00
1280+00
1320+00
1340+00
1360+00
1380+00
1400+00
1420+00
1440+00
1493+80
355
CHANNEL STATIONS
LEGEND
TOP OF BRIDGE DECK
TOP OF BRIDGE OPENING
100-YEAR FLOOD ELEVATION
50-YEAR FLOOD ELEVATION
CHANNEL BOTTOM
CROSS SECTION NUMBER
CHANNEL STATION
20
22+47
CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn
Traced
Checked
Date
Approved by
Title
Drawing No.
8 of 13
SCS-ENG-316 (Rev. 2-69)

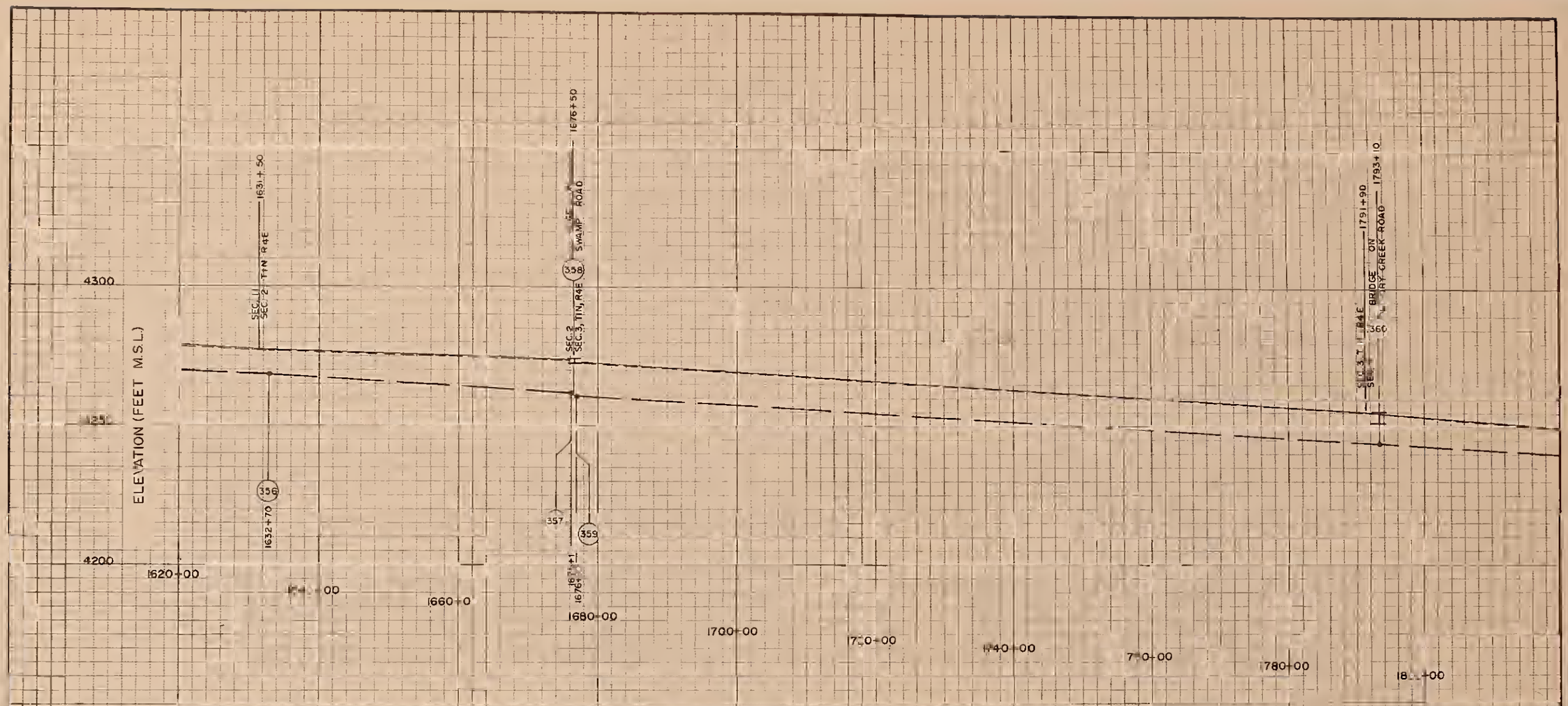


CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date	Approved by:	
Designed	Title	
Drawn	Title	
Traced	Sheet No	Drawing No. 9 of 13
Checked	of	

SCS-ENG-316 (Rev. 2-69)



CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
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Drawn		Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 10 of 13

SCS-ENG-316 (Rev. 2-69)

ELEVATION (FEET M.S.L.)

4200

4150

1800+00

1820+00

1840+00

1860+00

1880+00

1900+00

1920+00

1940+00

1960+00

1980+00

CHANNEL STATIONS

361 363

362

365

364 366

1857+30

1858+70

1853+70

1854+70

1942+4

1956+30

1956+70

RIDGE ON MANHATTAN-DRY CREEK ROAD

SEC. 4, T.1N., R.4E.
SEC. 33, T.2N., R.4E.

SEC. 33
SEC. 32, T.2N., R.4E.

N
SPAULDING ROAD

LEGEND

- TOP OF BRIDGE DECK
- TOP OF BRIDGE OPENING
- 100-YEAR FLOOD ELEVATION
- 50-YEAR FLOOD ELEVATION
- CHANNEL BOTTOM
- CROSS SECTION NUMBER
- CHANNEL STATION

00

11+11

CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
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Drawn
Traced
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Title
Title
Sheet No. 11 of 13
Drawing No.

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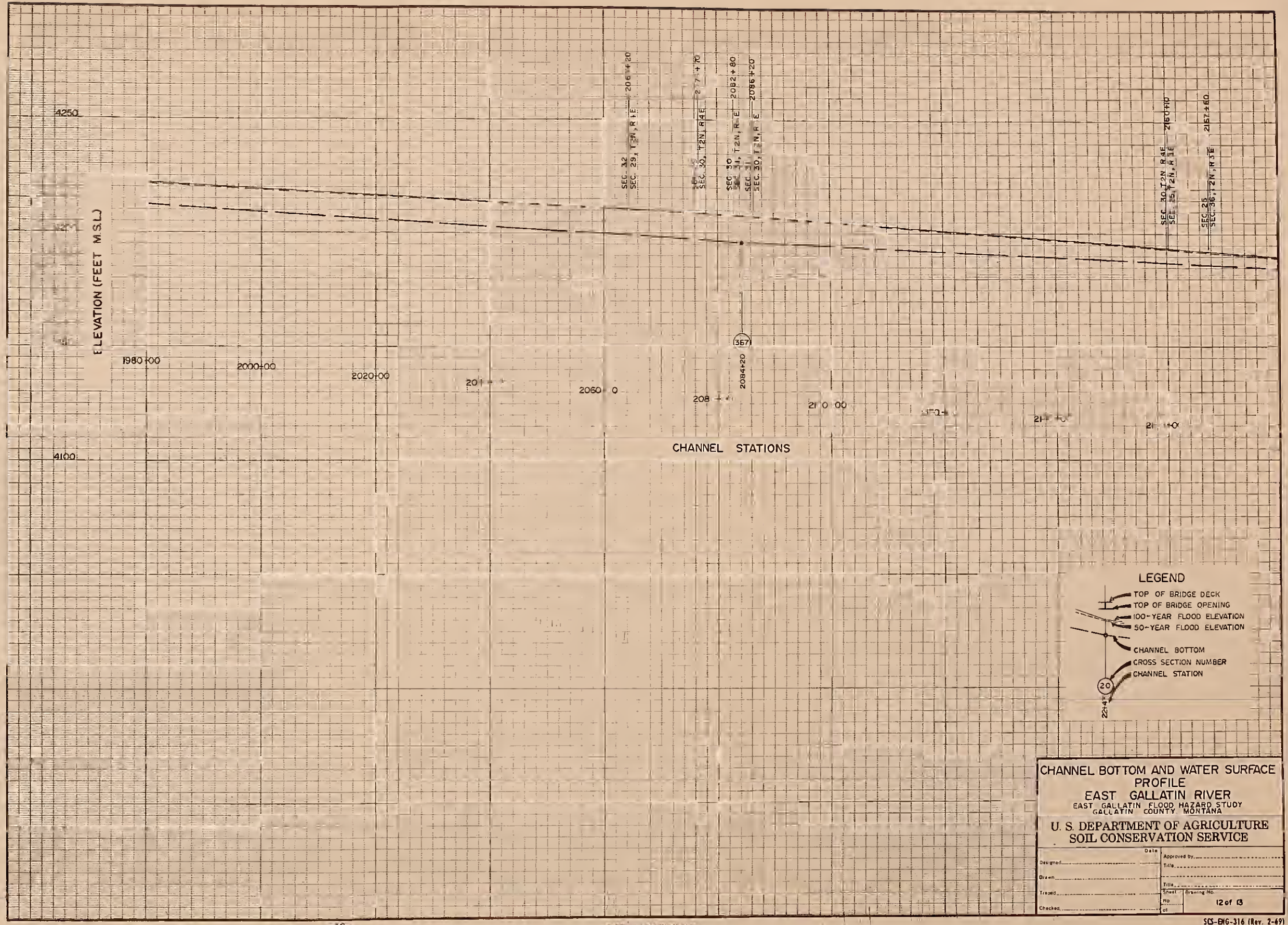
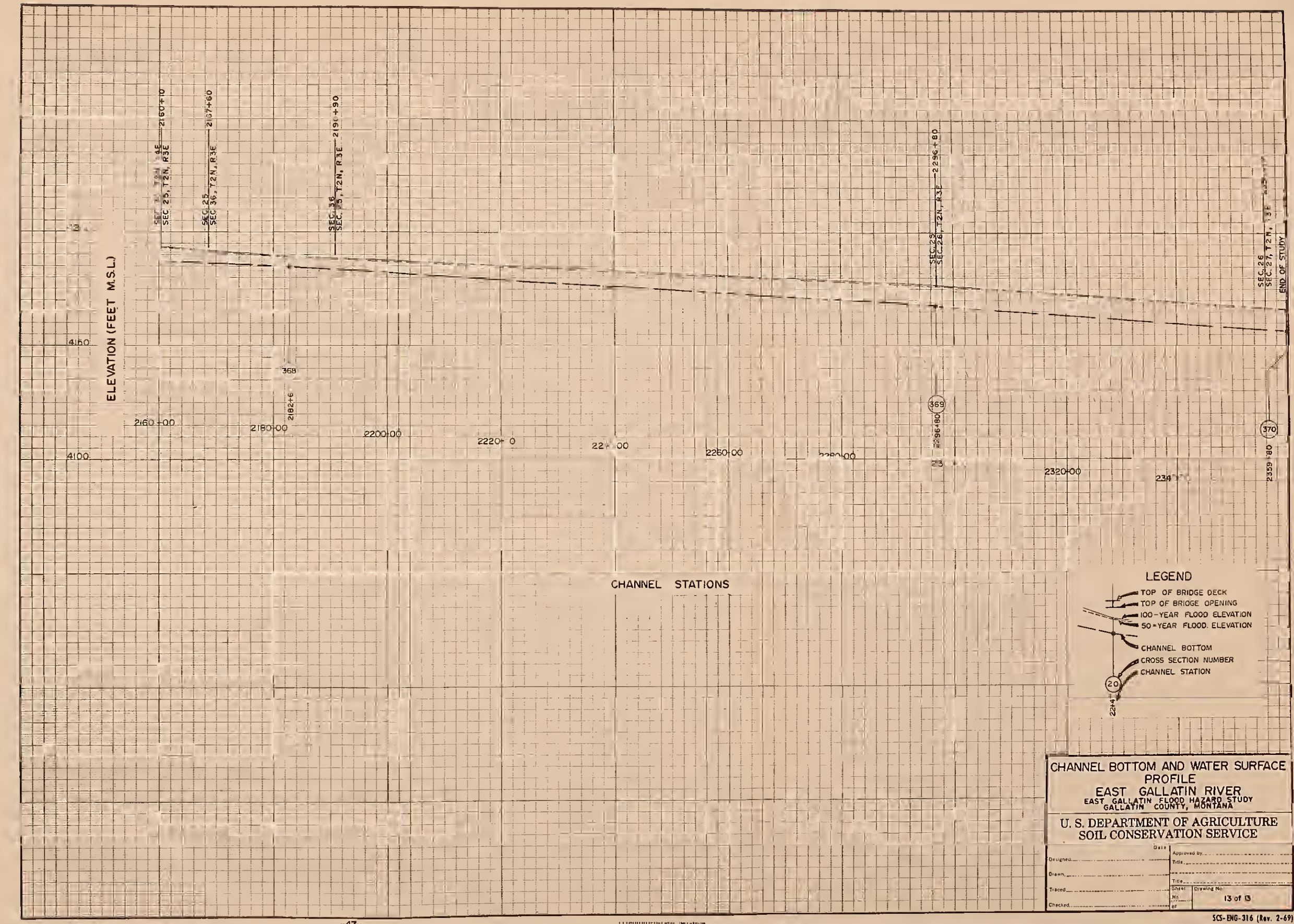


CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date	Approved by:
Designed	Title
Drawn	Title
Traced	Sheet No. 12 of 13
Checked	Drawing No.

SCS-ENG-316 (Rev. 2-69)



CHANNEL BOTTOM AND WATER SURFACE PROFILE
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
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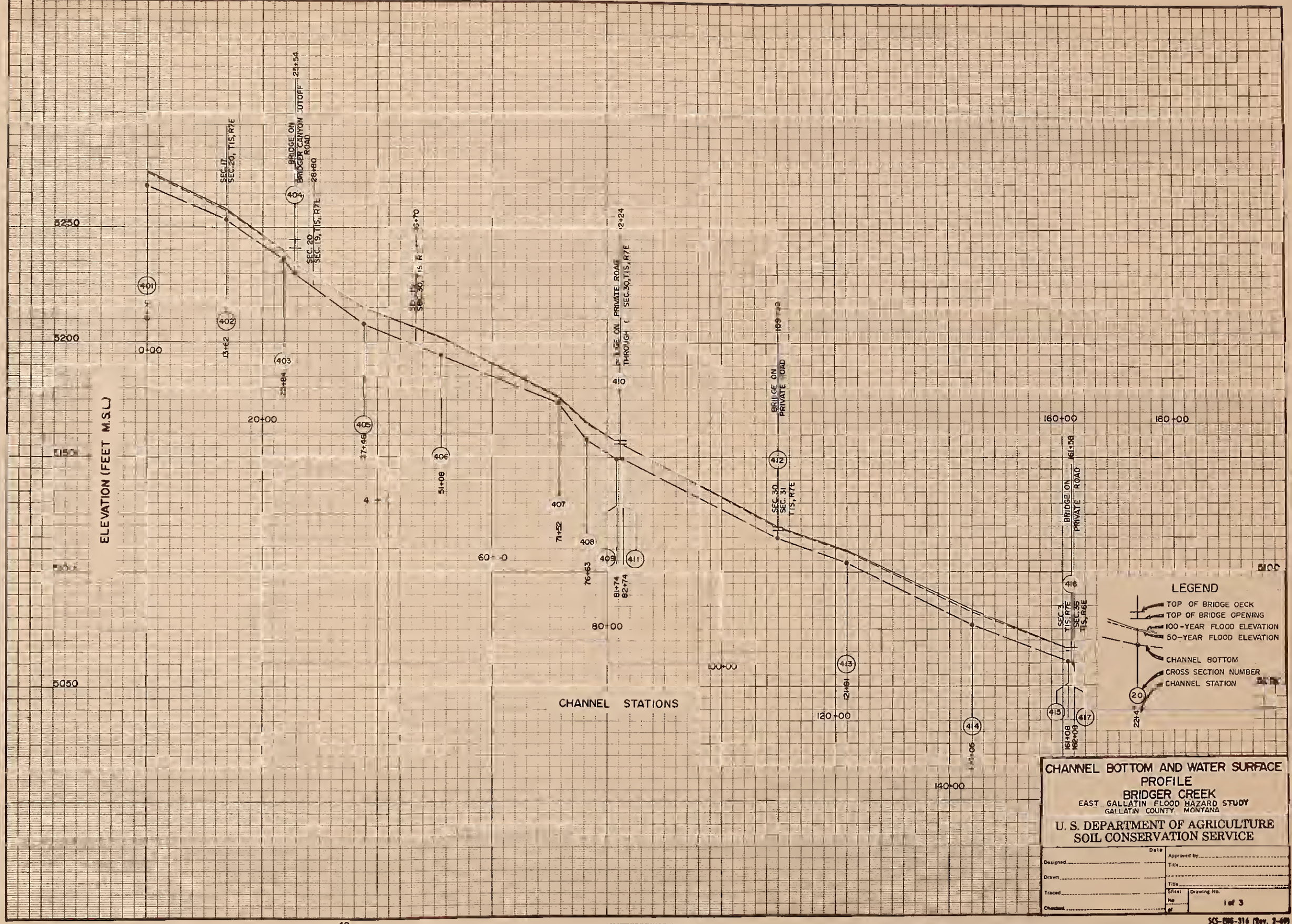
Drawn		Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 13 of 13

SCS-ENG-316 (Rev. 2-69)

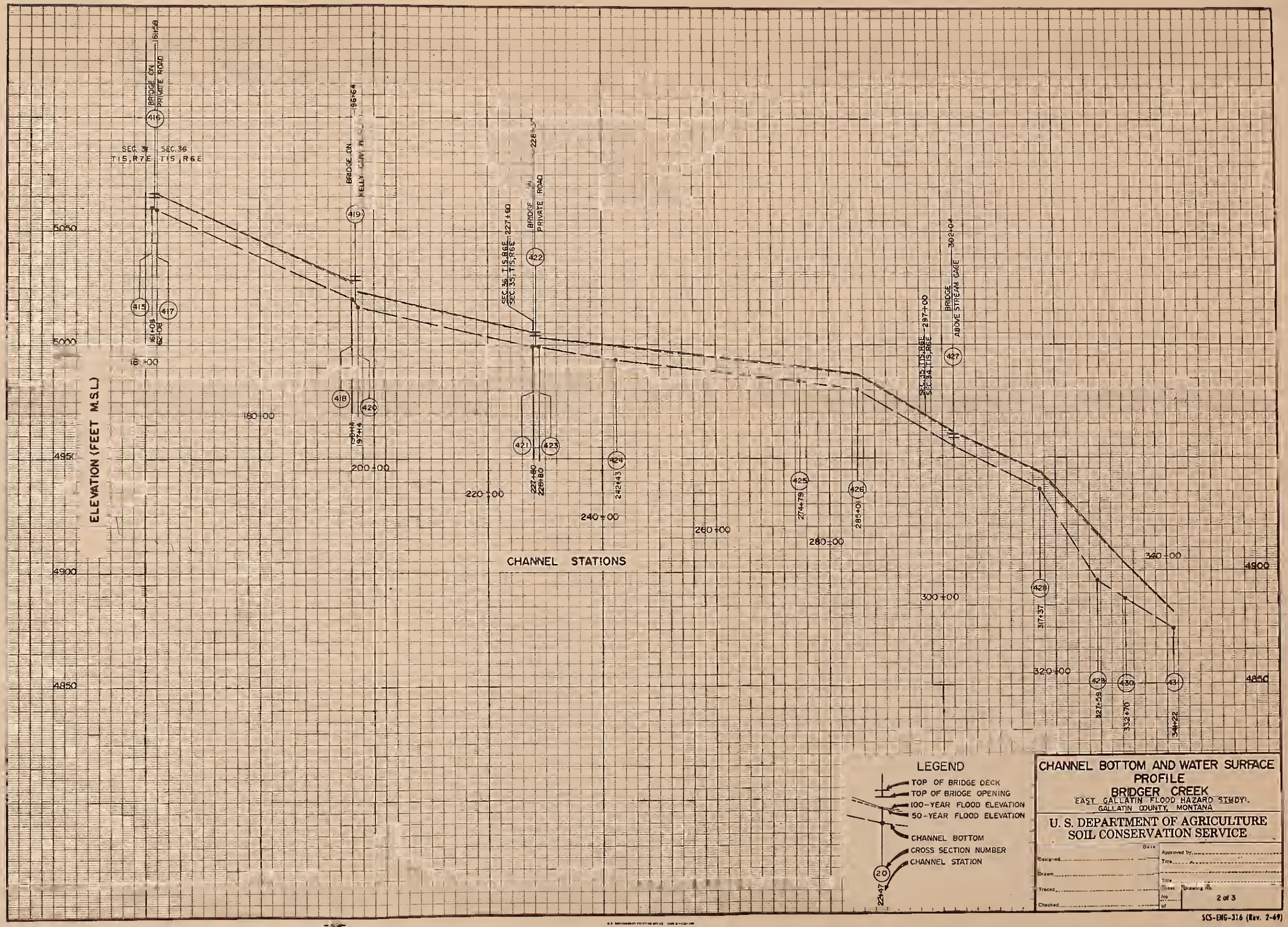


CHANNEL BOTTOM AND WATER SURFACE PROFILE
BRIDGER CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn		Title	
Traced		Title	
Checked		Sheet No. of	Drawing No. 1 of 3

SCS-ENG-316 (Rev. 3-69)

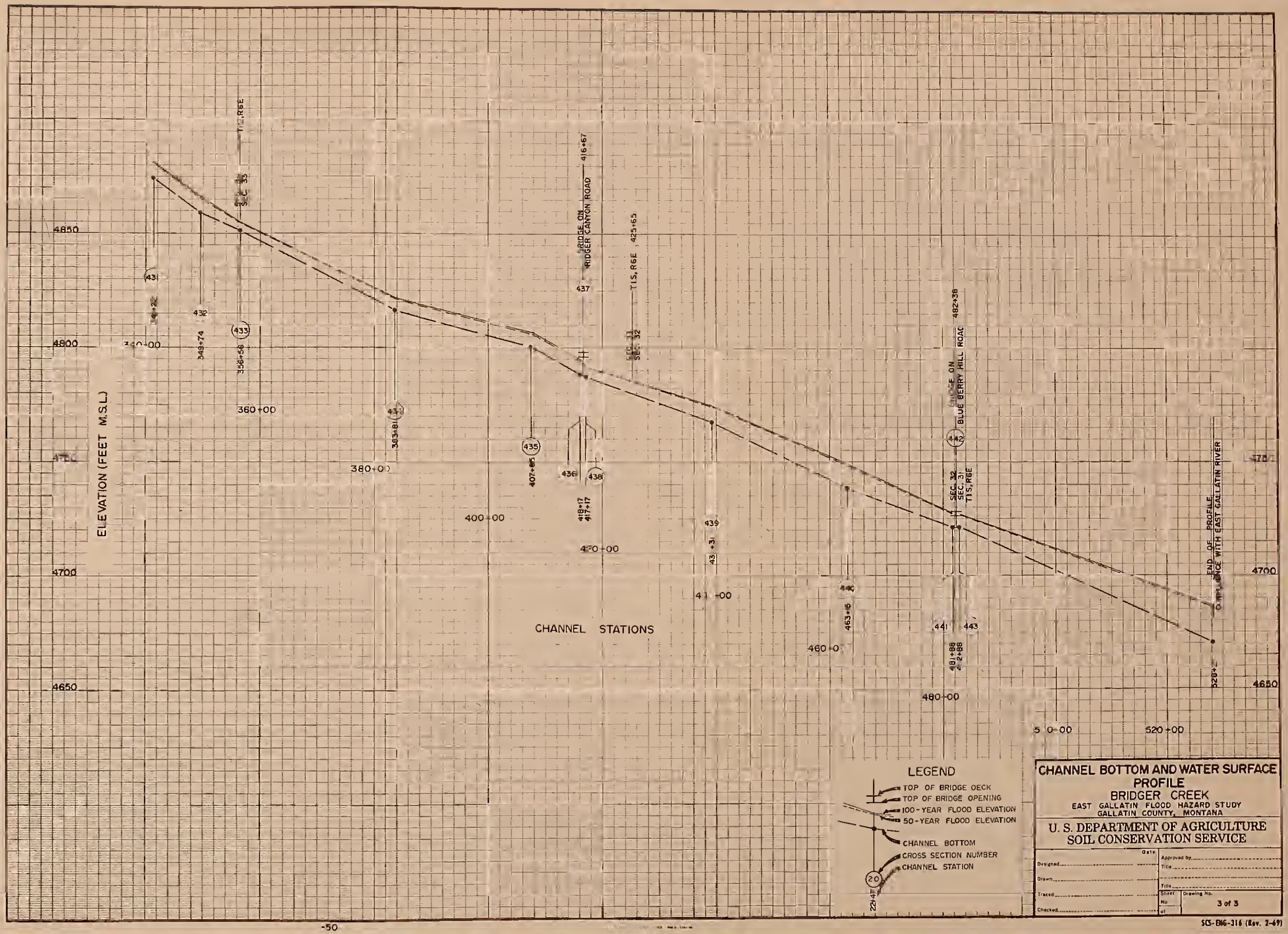


CHANNEL BOTTOM AND WATER SURFACE PROFILE
BRIDGER CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed | Date | Approved by
Drawn | | Title
Traced | | Title
Checked | Sheet No. of | Drawing No. 2 of 3

SCS-ENG-316 (Rev. 2-69)



CHANNEL BOTTOM AND WATER SURFACE PROFILE
BRIDGER CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
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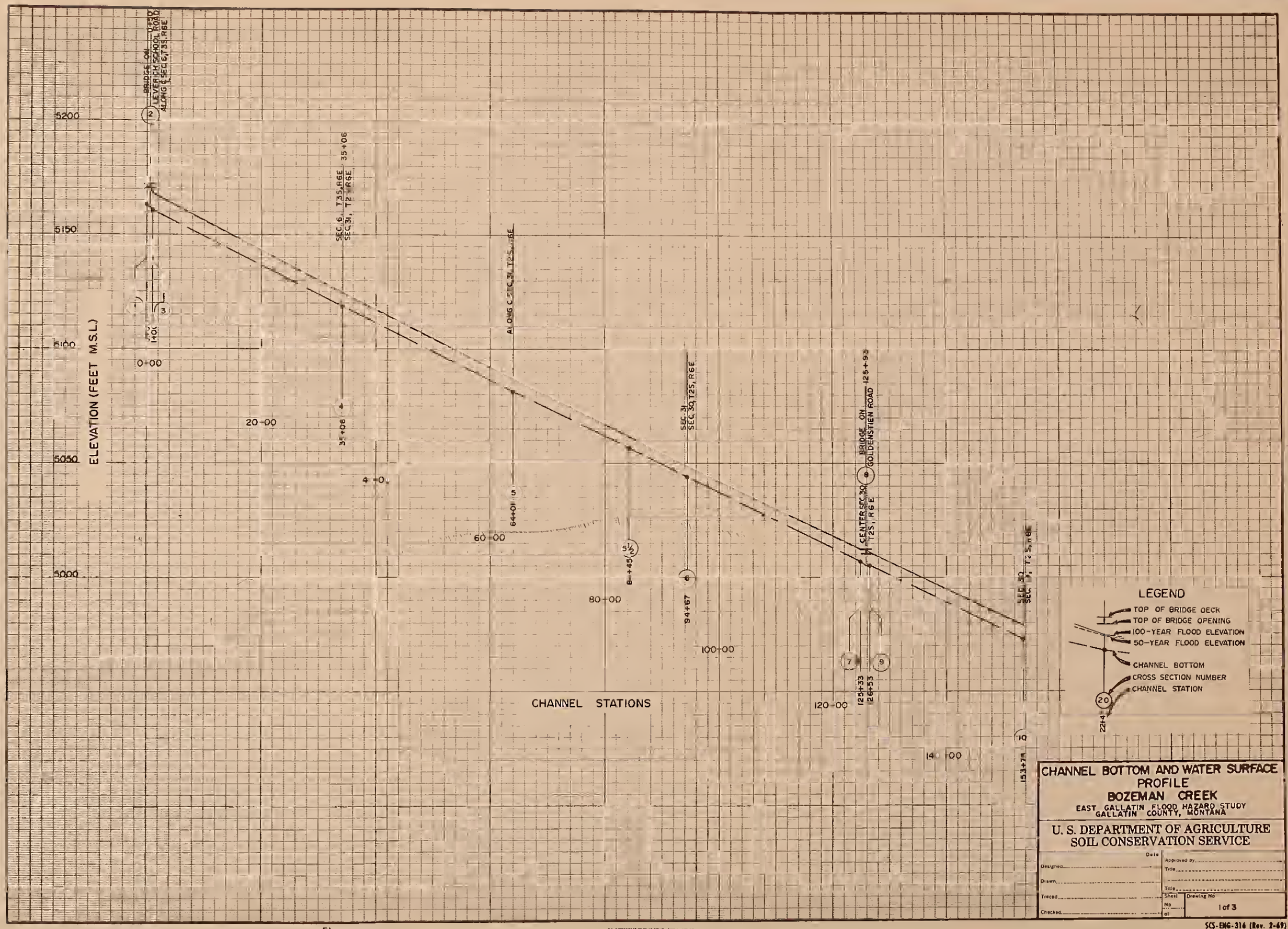

CHANNEL BOTTOM AND WATER SURFACE PROFILE
BOZEMAN CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

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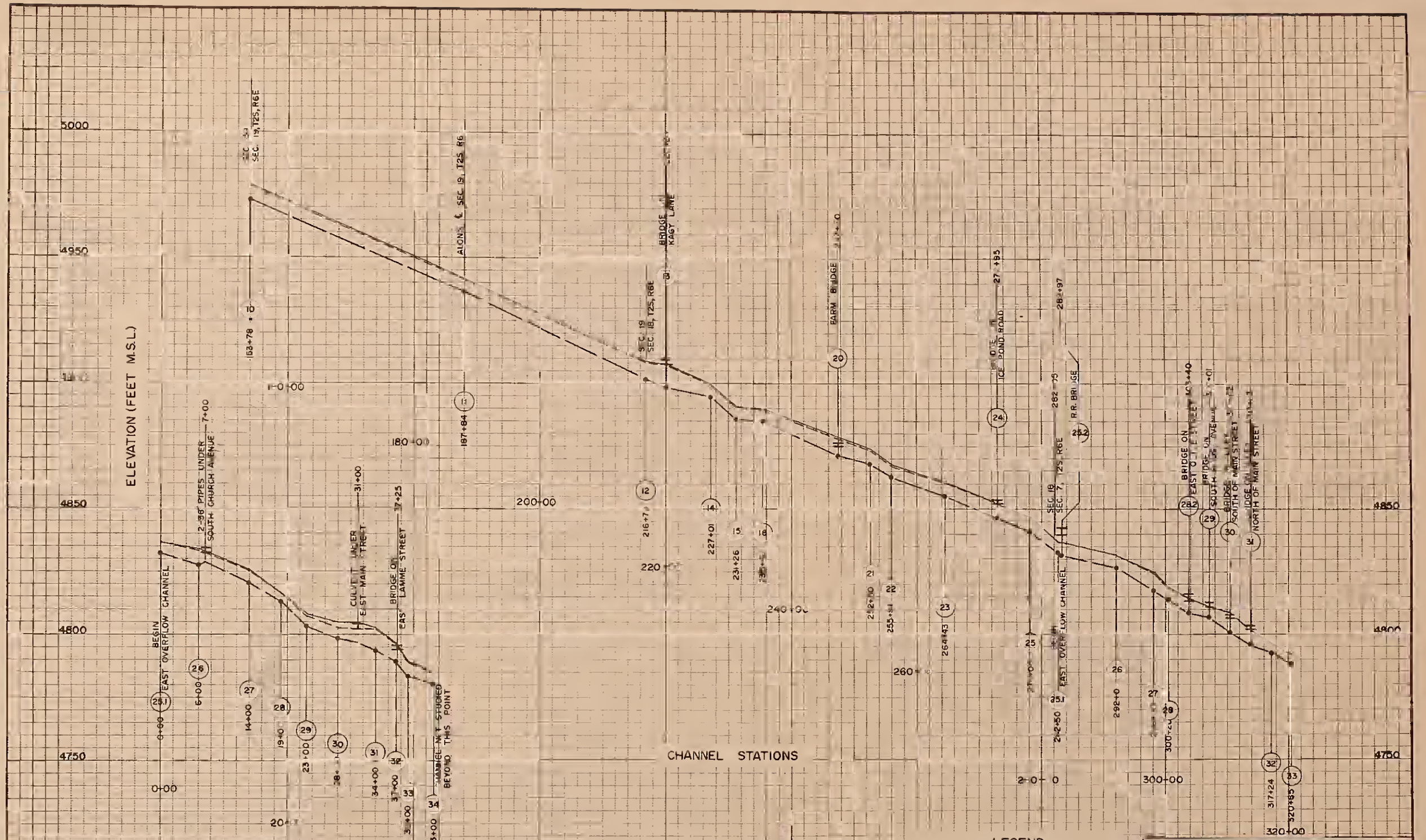

CHANNEL BOTTOM AND WATER SURFACE PROFILE
BOZEMAN CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

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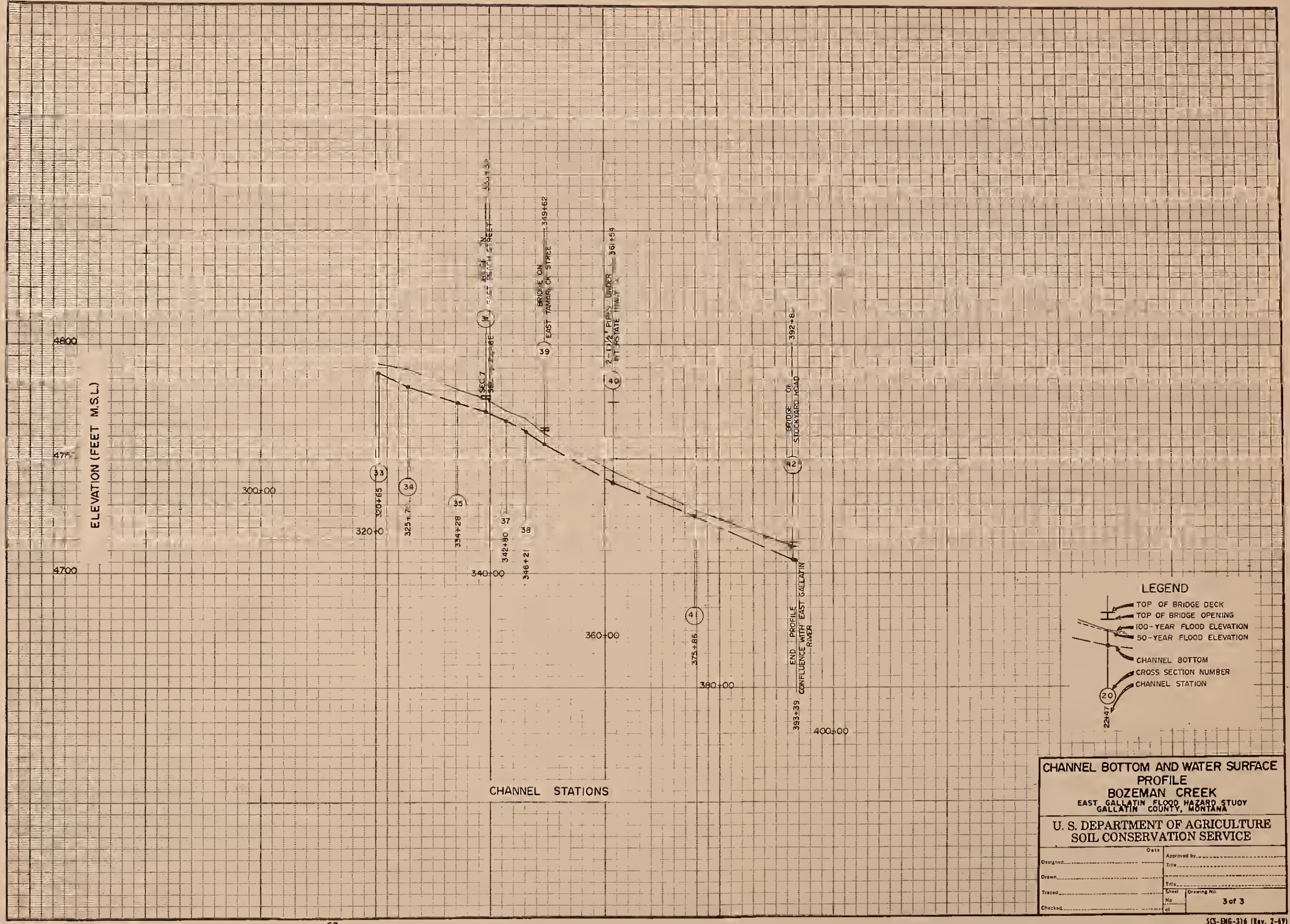

CHANNEL BOTTOM AND WATER SURFACE PROFILE
BOZEMAN CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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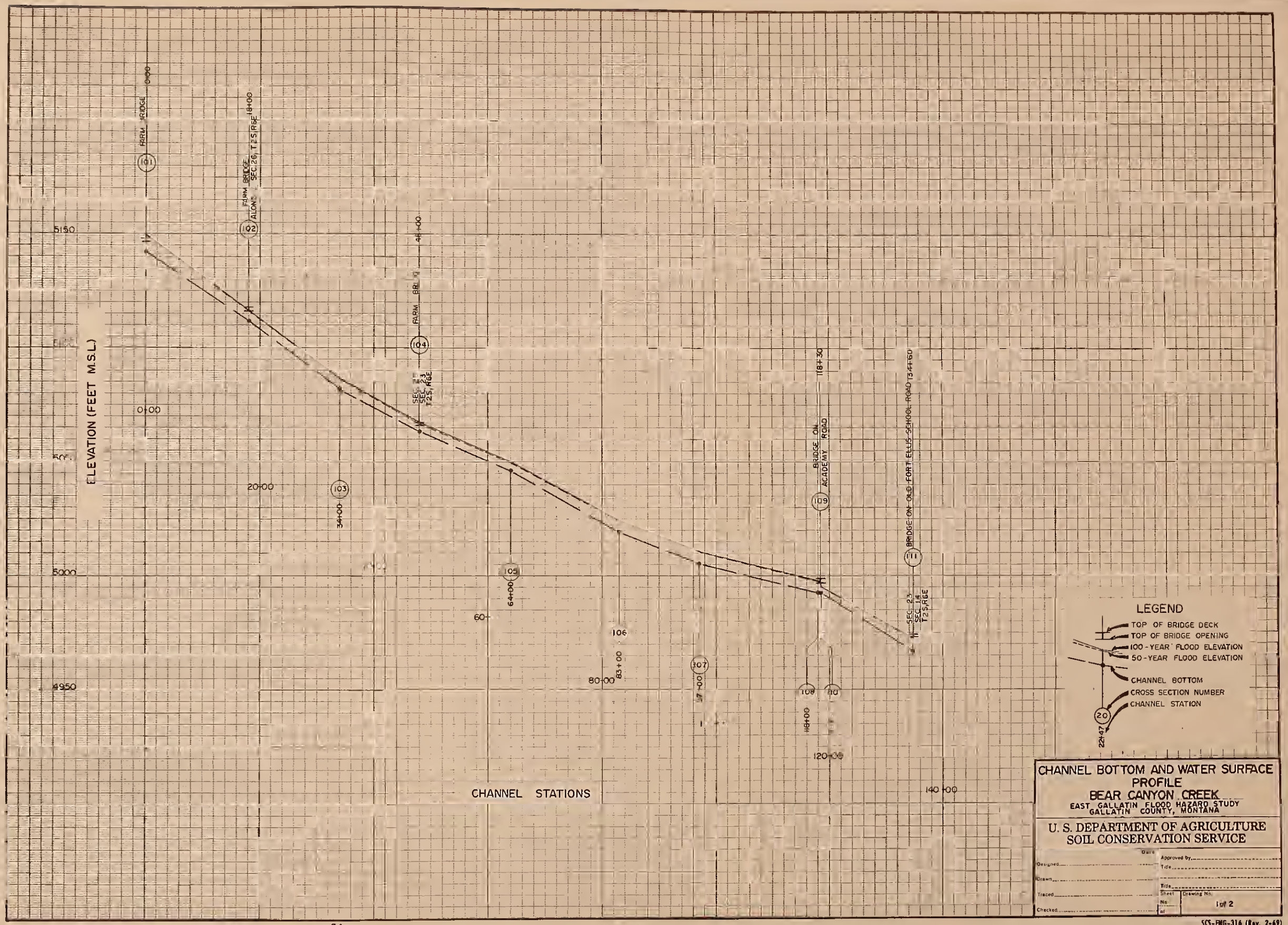

CHANNEL BOTTOM AND WATER SURFACE PROFILE
BEAR CANYON CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
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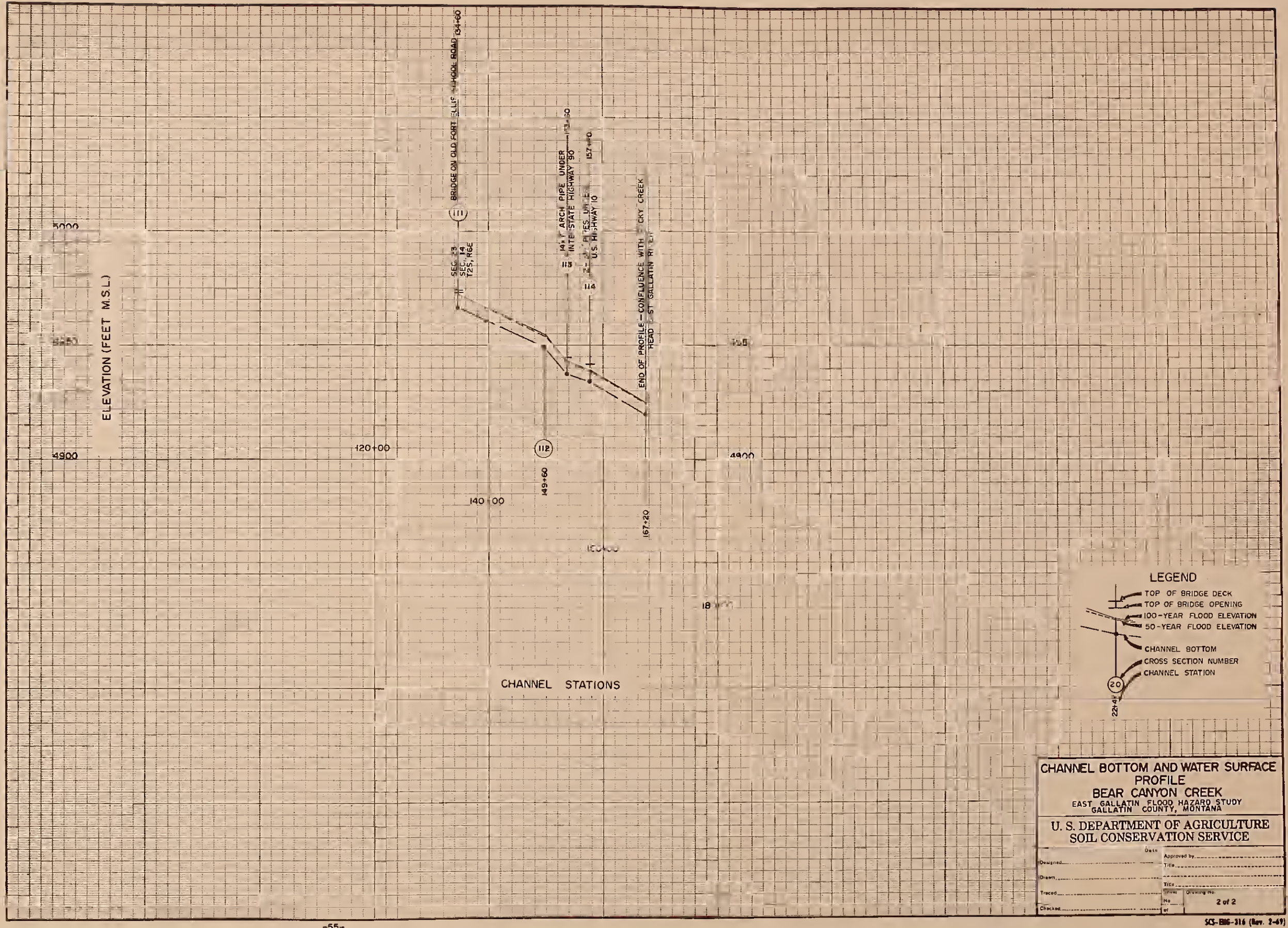

CHANNEL BOTTOM AND WATER SURFACE PROFILE
BEAR CANYON CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
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ELEVATION (FEET M.S.L.)

5050
5000
4950
4900
4900

BRIDGE ON LOWER CANYON ROAD — 41+40

E.C. 23
S.C. 14
T2S, R6E

82+00

201 202 203 204 206 207 208 209

0+00 11+0 0+00 20+00 25+00 41+00 55+80 85+80 100+80 104+70 100+00 120+00

40 6 — 0 80-00

CONFLUENCE WITH REAR CANYON CREEK
HEAD EAST GALLATIN R.

CHANNEL STATIONS

LEGEND

- TOP OF BRIDGE DECK
- TOP OF BRIDGE OPENING
- 100-YEAR FLOOD ELEVATION
- 50-YEAR FLOOD ELEVATION
- CHANNEL BOTTOM
- CROSS SECTION NUMBER
- CHANNEL STATION

20
22+47

CHANNEL BOTTOM AND WATER SURFACE PROFILE
ROCKY CREEK

EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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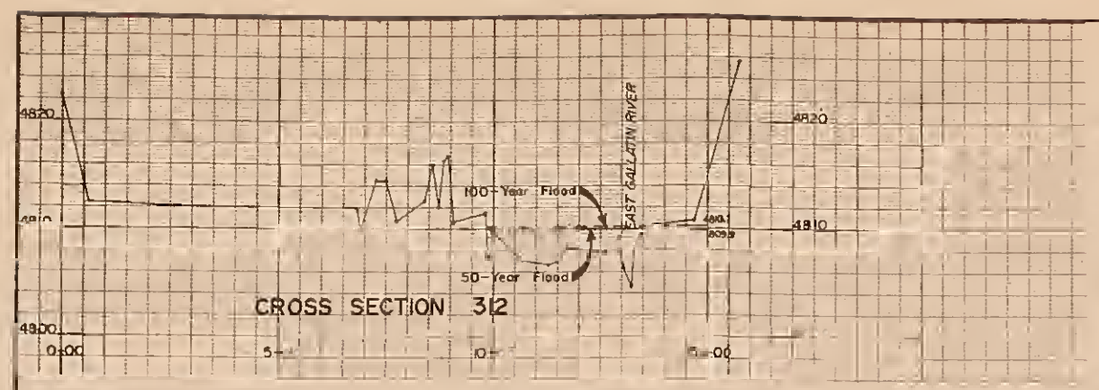
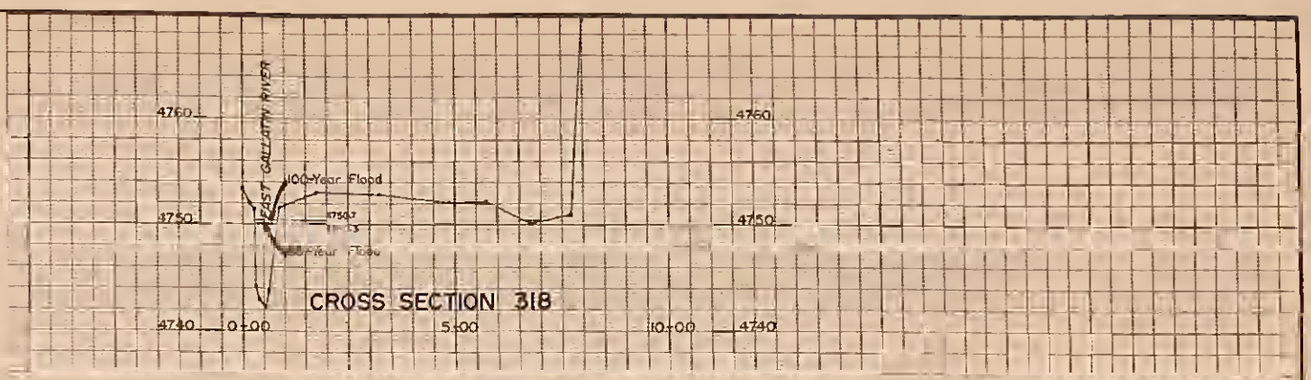
SCS-ENG-316 (Rev. 1-69)



CROSS SECTION 312



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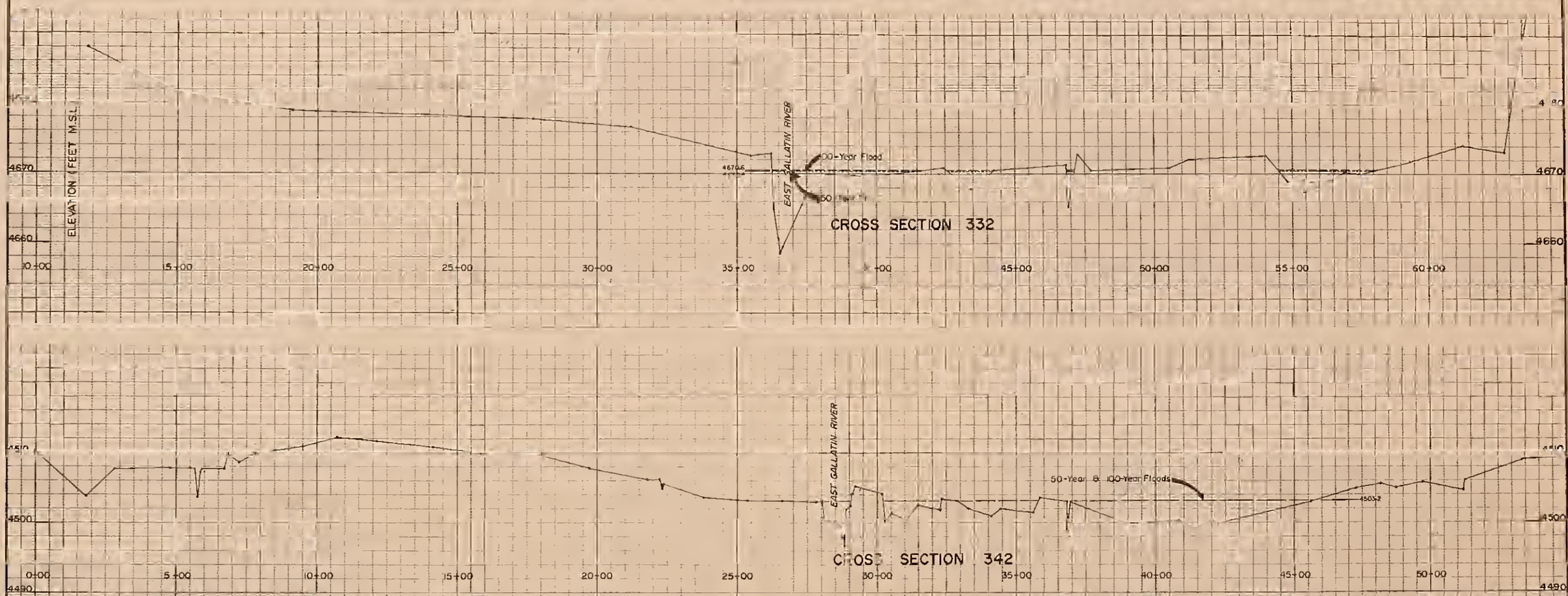

CROSS SECTION 332

CROSS SECTION 342

NOTE: (1) ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)
(2) STATIONS IN FEET FROM LEFT TO RIGHT LOOKING DOWNSTREAM

TYPICAL VALLEY CROSS SECTIONS
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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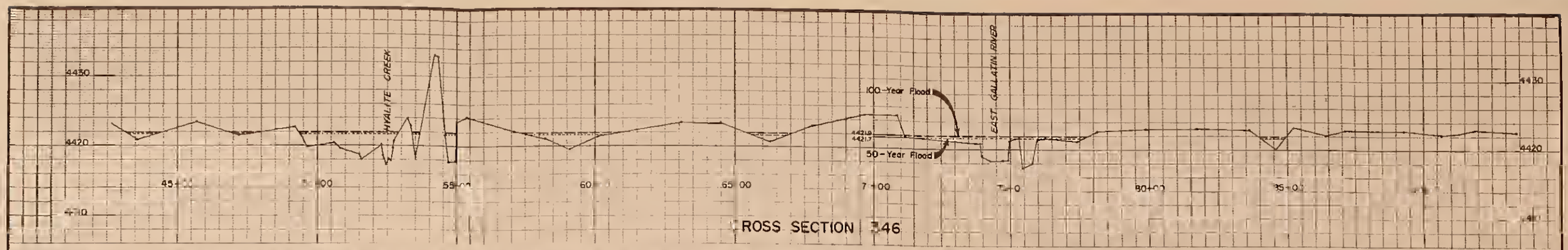

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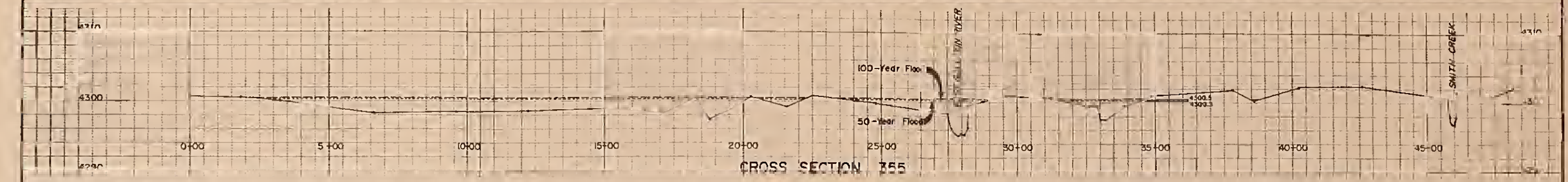

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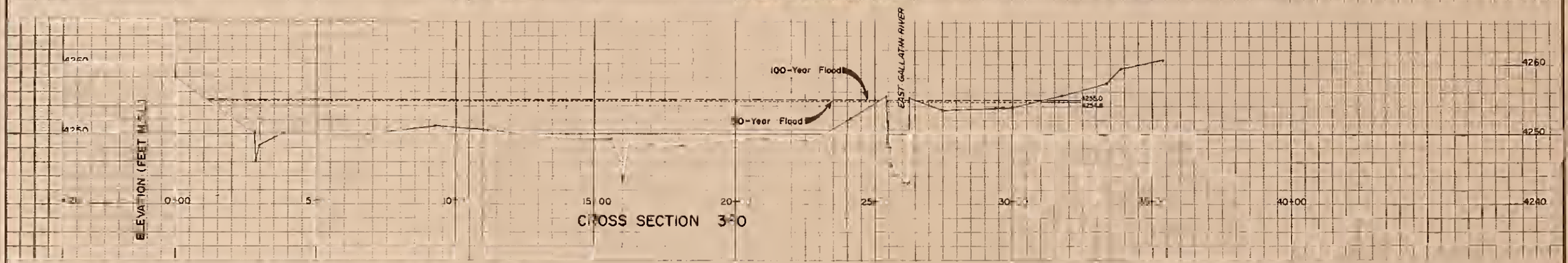

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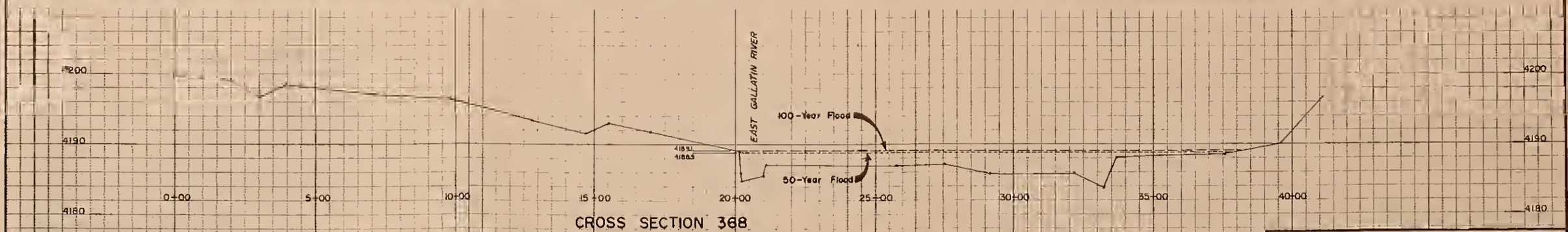

CROSS SECTION 388

NOTE: (1) ELEVATION IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)

(2) STATIONS IN FEET FROM LEFT TO RIGHT LOOKING DOWNSTREAM

TYPICAL VALLEY CROSS SECTIONS
EAST GALLATIN RIVER
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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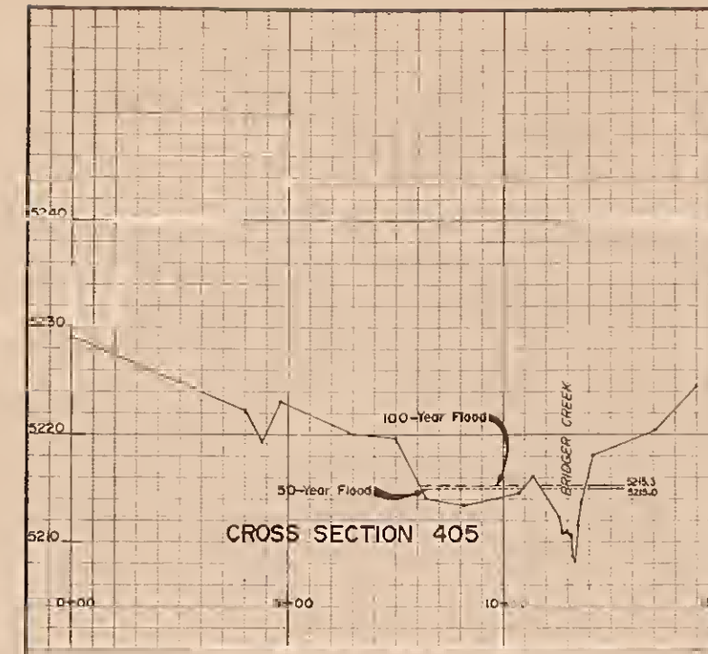

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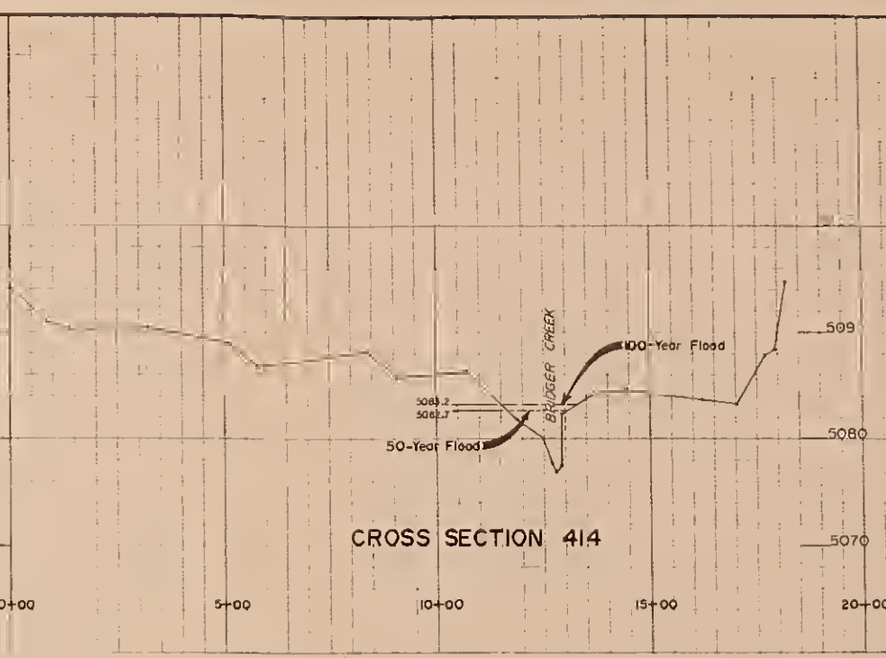
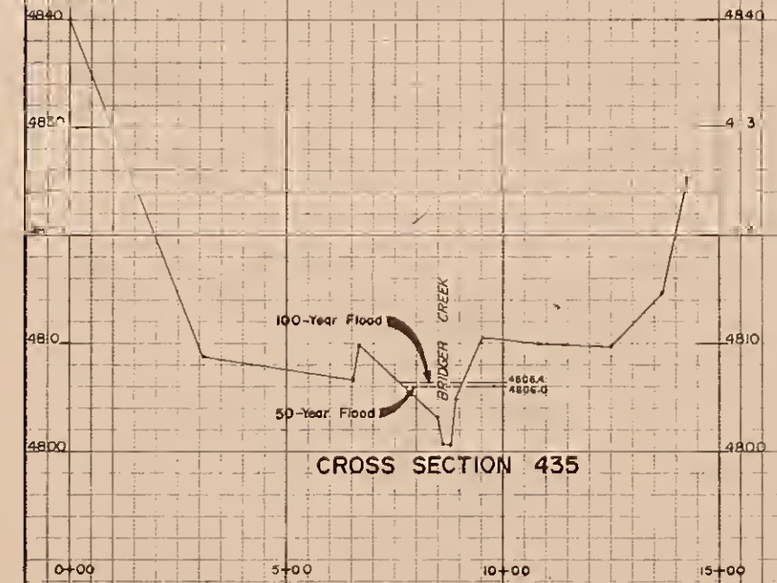
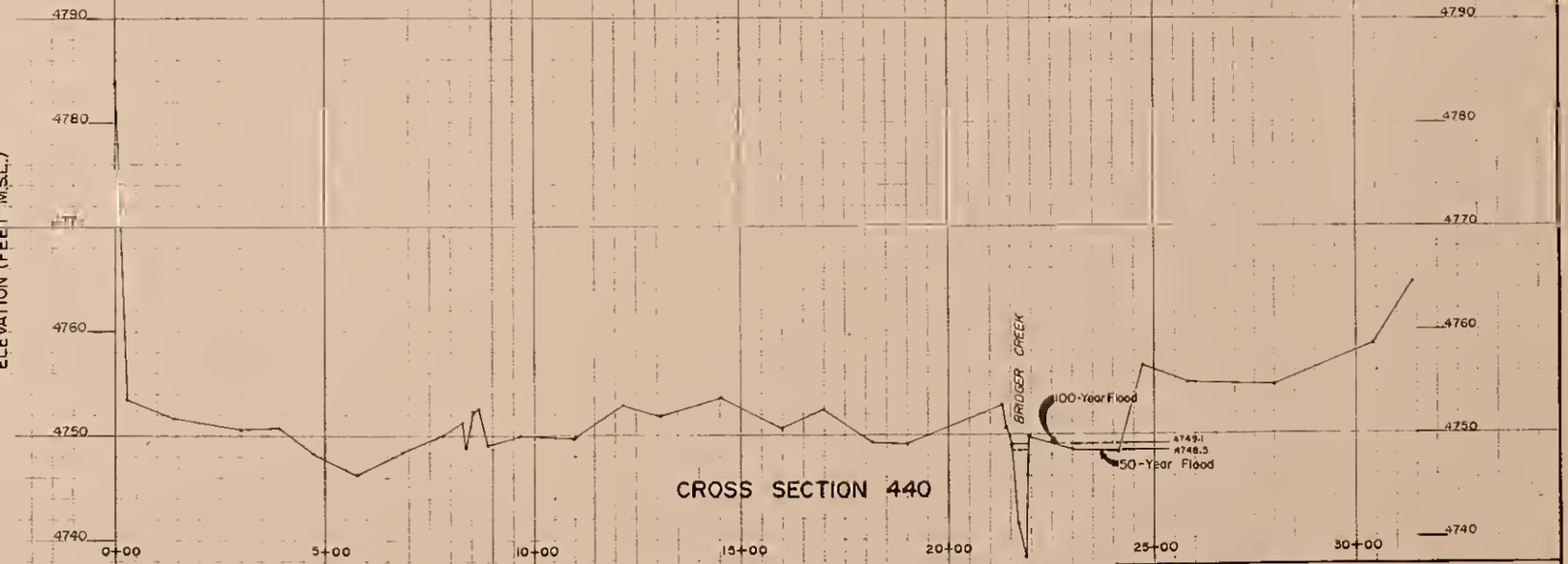


CROSS SECTION 414

ELEVATION (FEET M.S.L.)



CROSS SECTION 435



CROSS SECTION 440

NOTE: (1) ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)

(2) STATIONS IN FEET FROM LEFT TO RIGHT LOOKING DOWNSTREAM

TYPICAL VALLEY CROSS SECTIONS
BRIDGER CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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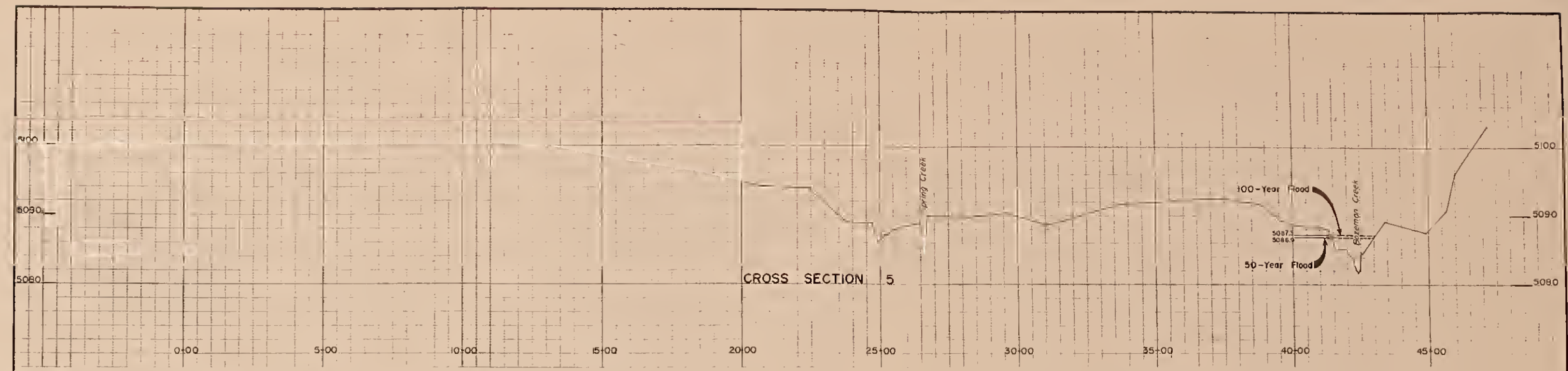
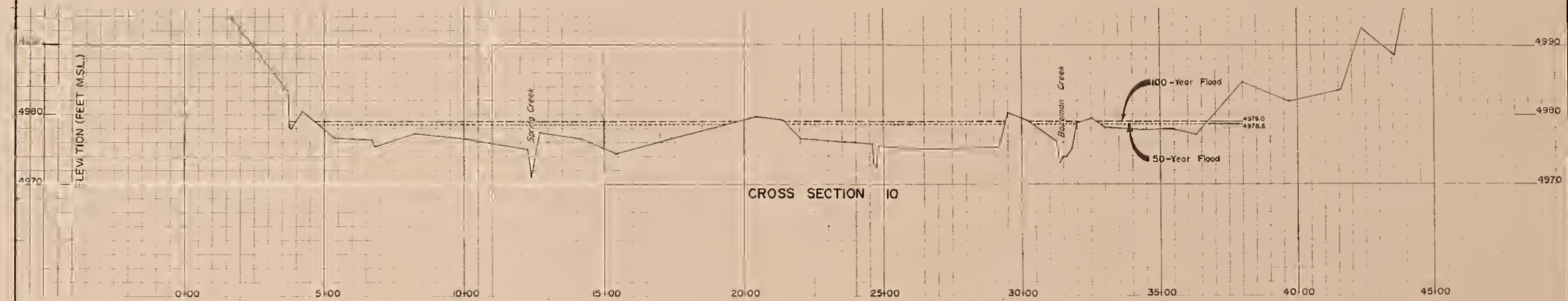
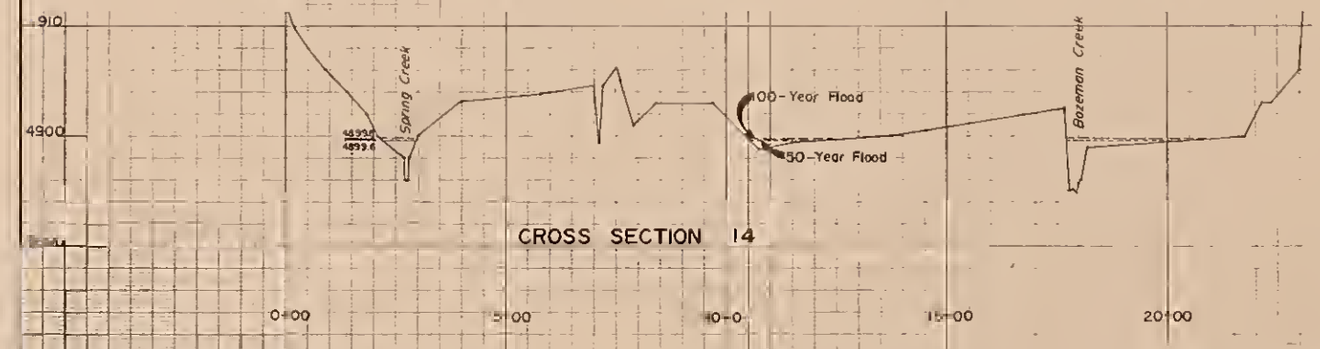


CROSS SECTION 5



CROSS SECTION 10



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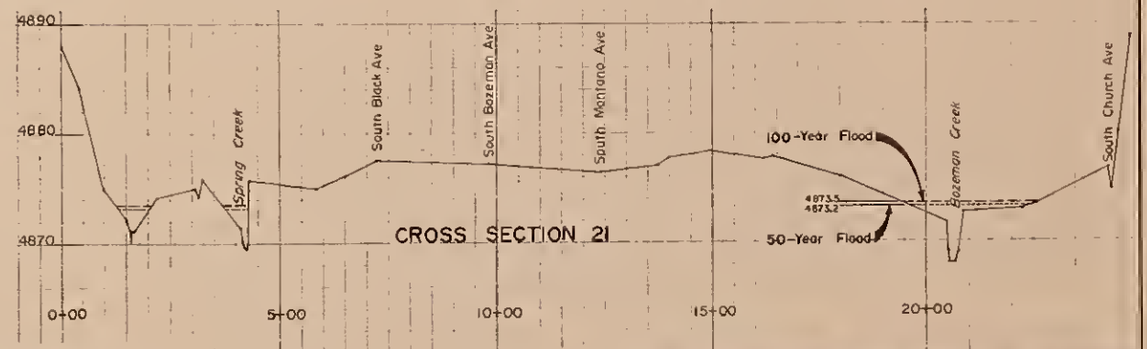

CROSS SECTION 21

NOTE (1) ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)

(2) STATIONS IN FEET FROM LEFT TO RIGHT LOOKING DOWNSTREAM

TYPICAL VALLEY CROSS SECTIONS
BOZEMAN CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
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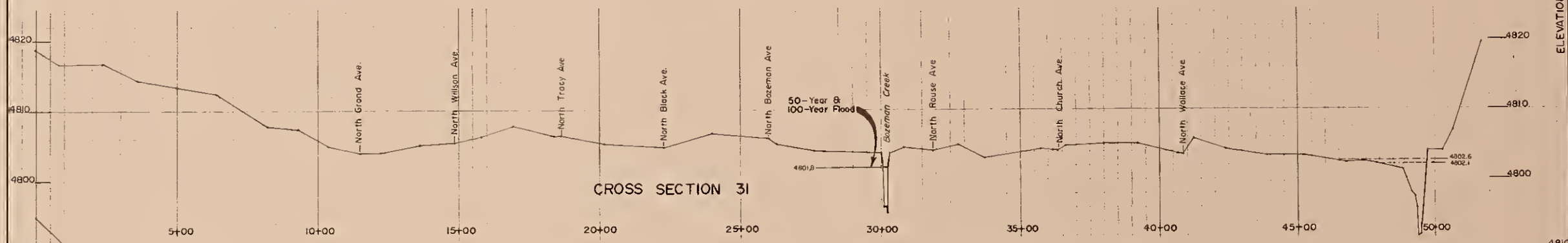
CROSS SECTION 25

CROSS SECTION 28



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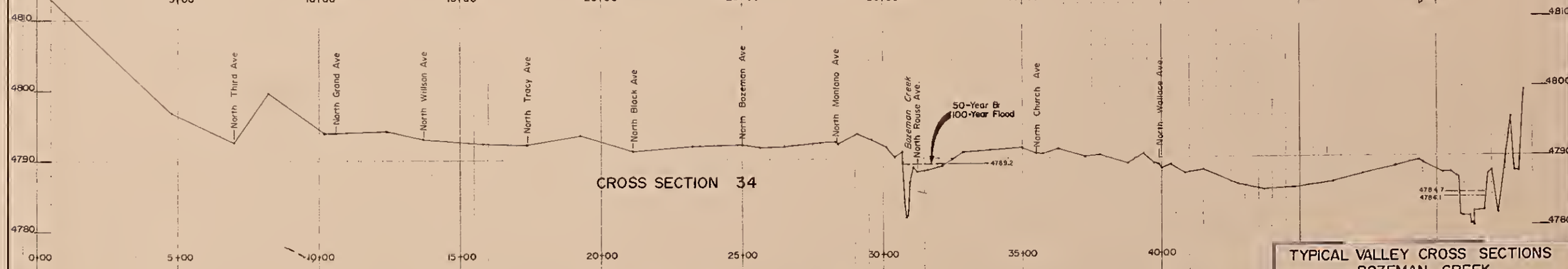

CROSS SECTION 34

NOTE: (1) ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)

(2) STATIONS IN FEET FROM LEFT TO RIGHT LOOKING DOWNSTREAM

ELEVATION (FEET M.S.L.)

TYPICAL VALLEY CROSS SECTIONS
BOZEMAN CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

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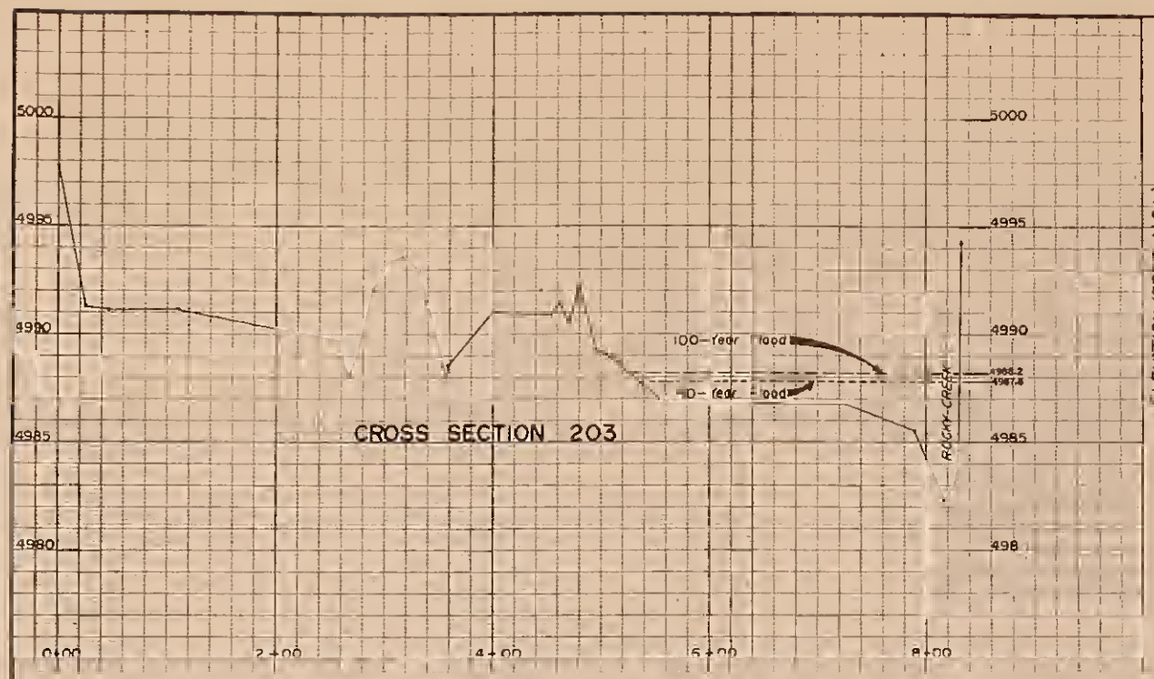

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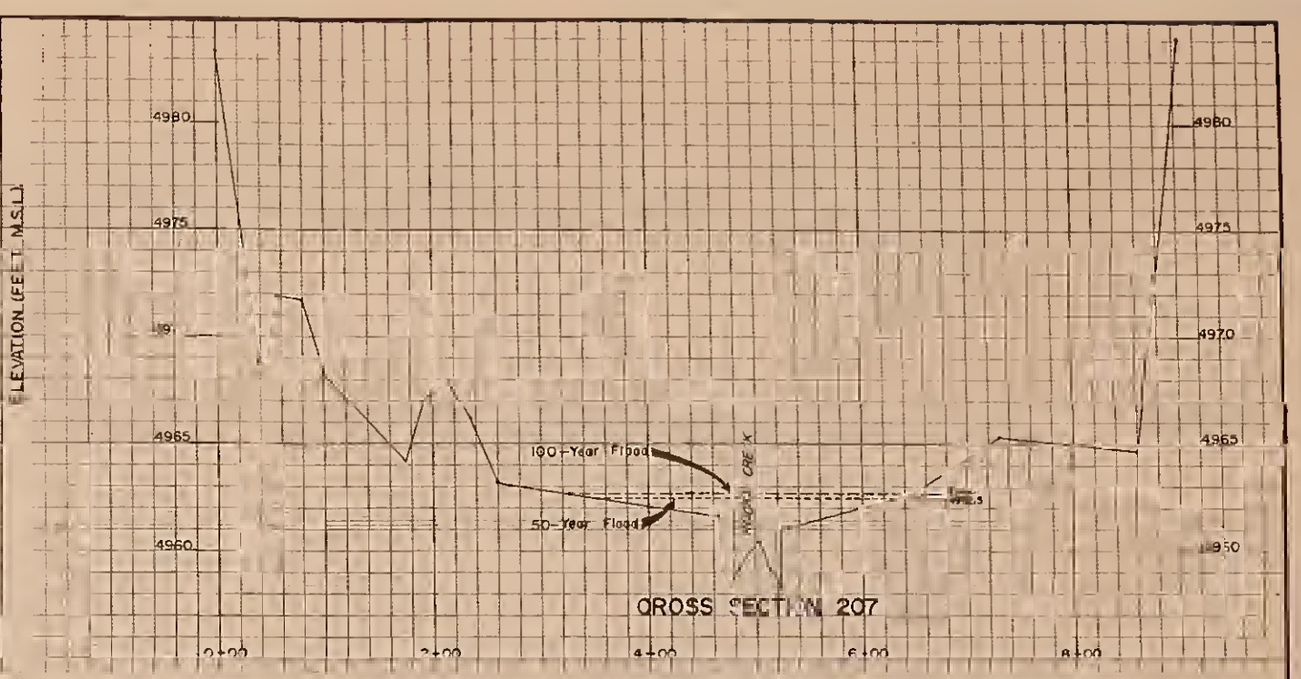

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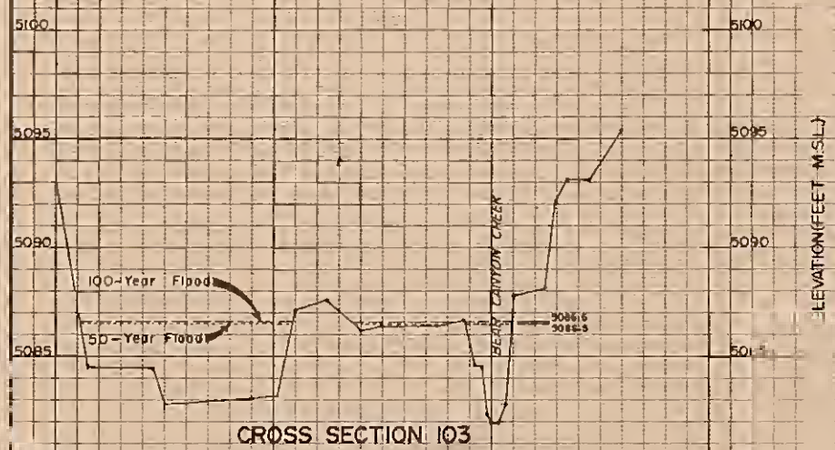

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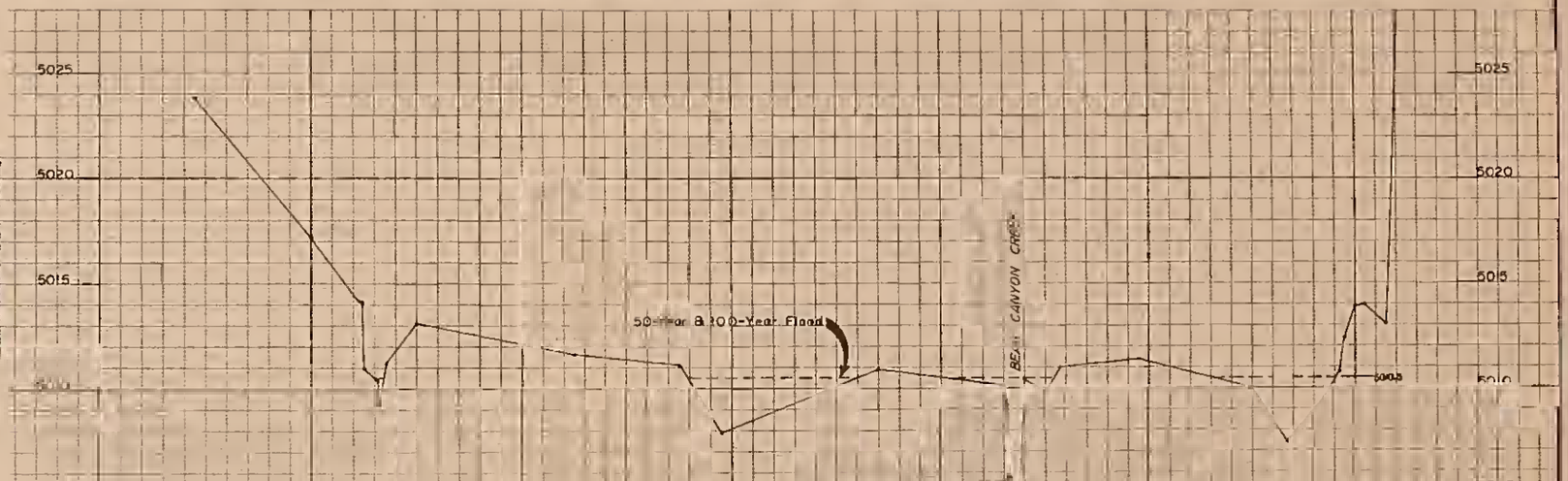

CROSS SECTION 107

NOTE: (1) ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (M.S.L.)

(2) STATIONS IN FEET FROM LEFT TO RIGHT, LOOKING DOWNSTREAM

TYPICAL VALLEY CROSS SECTIONS
ROCKY CREEK & BEAR CANYON CREEK
EAST GALLATIN FLOOD HAZARD STUDY
GALLATIN COUNTY, MONTANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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A P P E N D I C E S

APPENDIX A

SOILS

Following are descriptions, explanation of interpretations, and table of interpretations of the ten soil mapping units used in this report. Soil area boundaries and symbols are shown on the aerial mosaic maps.

Descriptions of Mapping Units

A -- This mapping unit consists of well drained, nearly level and gently sloping soils that are more than 40 inches thick over alluvial materials--mainly sand and gravel. The surface layers are mainly loam and silt loam, but some are sandy loam or friable clay loam. The subsoils are mainly loam and clay loam, but some are sandy loam, silt loam, or silty clay loam.

These soils have an estimated permeability of moderate or moderately slow (0.2 to 2.0 inches per hour). They have an available water capacity of 6 to 12 inches. Many of these soils have a seasonal fluctuating water table between 5 and 12 feet, but it seldom remains at 5 or 6 feet for a very long period because of a freely draining substratum. Most of these soils are neutral or mildly alkaline and have medium or high organic matter content in their surface layers. Some were formed under high water table conditions, but are presently well drained. Most areas of this mapping unit are not subject to flooding or are only rarely flooded.

Within this mapping unit are a few small areas of wet soils, mainly in narrow swales too small to show separately on the map.

These soils are mostly used for grain, hay, and tame pasture. Some are irrigated. Residential developments are taking place on these soils.

B -- This mapping unit consists of well drained, nearly level and gently sloping soils that are 20 to 40 inches thick over sand and gravel alluvium. The surface layers are mainly loam and silt loam, but some are sandy loam, friable clay loam, or gravelly loam. The subsoils are similar in texture to the surface layer, but they often have thin strata of varying texture.

These soils have an estimated permeability of moderate or moderately slow (0.2 to 2.0 inches per hour). They have an available water capacity of 4 to 8 inches. Many of these soils have a seasonal fluctuating water table between 5 and 12 feet. Most of these soils are neutral or mildly alkaline and have medium or high organic matter content in their surface layers. Most areas are not subject to flooding or are only rarely flooded.

Included in this mapping unit are a few small areas of wet soils in narrow swales too small to show separately on the map. Most areas are quite uniform in depth to sand and gravel, but in some there are a few scattered areas of deep soils. In other areas there are narrow bands of soils that are only 10 to 20 inches deep over the sand and gravel.

These soils are used mostly for grain, hay, or tame pasture. Some are irrigated. Residential developments are taking place on these soils.

C -- This mapping unit consists of well drained, nearly level and gently sloping soils that are 10 to 20 inches thick over sand and gravel. The surface layers are mainly loam and gravelly loam, have medium organic matter, and are neutral to mildly alkaline. The subsoil is similar to the surface layer, but there is some stratification of materials.

The estimated permeability of the upper part of the soil is moderate (0.6 to 2.0 inches per hour). The gravelly substratum is rapidly permeable (6 to 20 inches per hour). The available water capacity is 2 to 4 inches. Some of these soil areas have a seasonal fluctuating water table below 5 feet.

Within this mapping unit are a number of small areas similar to those of mapping unit B. There are also small areas of wet soils in swales and small cut-off stream channels.

These soils are used mainly for hay and tame pasture. A few areas are used for small grain, irrigated crops, or native range. Residential developments are taking place on these soils.

D -- This mapping unit consists of somewhat poorly drained, nearly level soils that are more than 40 inches thick--mainly over sand and gravel. The surface layers are mainly loam and silt

loam, but some are sandy loam or friable clay loam. The subsoils are similar in texture, but there is commonly stratification of materials from loamy sands to silty clays.

Estimated permeability is moderate to moderately slow (0.2 to 2.0 inches per hour). The available water capacity is 6 to 12 inches. Most of these soils have a fluctuating water table between 30 and 60 inches. Soils of this mapping unit are neutral or mildly alkaline and have medium or high organic matter content. Many areas are subject to flooding.

Within this mapping unit are a few small areas of very wet soils and peat soils too small to show on the map.

Most of these soils are used for tame hay and pasture, but small grain production is also common. Some are irrigated and there is some residential development.

E -- This mapping unit consists of poorly drained and very poorly drained, nearly level soils that are more than 40 inches thick, mostly over sand and gravel. The surface layers are mainly loam and silt loam, but some are of sandy loam or clay loam. The subsoils are similar in texture, but stratification of loamy sands to silty clays is common.

Estimated permeability is moderate to moderately slow (0.2 to 2.0 inches per hour). The available water capacity is 6 to 12 inches. Most of these soils have a seasonal water table within 30 inches of the surface. Soils of this mapping unit are neutral or mildly alkaline and have medium or high organic matter content.

Within this mapping unit are some slightly wet soils, a few 20 to 40 inches thick over sand and gravel, and small areas of peat. These are too small to be shown on the map.

Most of these soils are in native range use. Sedges and rushes dominate the vegetation, but willows are common in places. Many of the areas are adjacent to intermittent and live streams and may be subject to flooding.

F -- This mapping unit consists of moderately well drained and somewhat poorly drained, nearly level soils that are 20 to 40 inches thick over sand and gravel. The surface layers are mainly loam and silt loam, but some are of sandy loam, clay loam, or gravelly loam. The subsoils are mostly similar in texture to the surface layer, but often have thin strata of varying texture.

These soils receive some supplemental moisture from a seasonal fluctuating water table or from short duration overflow. Most areas have a water table at 30 to 60 inches during part or all of the growing season. Some areas may be subject to flooding.

Estimated permeability of the upper 20 to 40 inches is moderate or moderately slow (0.2 to 2.0 inches per hour) and more than 6 inches per hour in the underlying material. The organic matter is high in many of these soils, but is low in the more recently deposited soils. The available water capacity is 4 to 8 inches. The reaction is neutral to mildly alkaline.

Within this mapping unit are a few small areas of wet soil, deep well drained soils, and shallow gravelly soils.

These soils are used as native pasture, tame hay and pasture, and small grain. Some of the areas along streams have abundant shrubs and cottonwood trees.

G -- This mapping unit consists of moderately well drained and somewhat poorly drained soils that are 10 to 40 inches thick over sand and gravel. The soils are mainly loam and sandy loam but some are gravelly. They have a seasonal water table within 30 inches of the surface during part of the growing season, but the soil drains freely as the water table lowers.

Estimated permeability is moderate (0.6 to 2.0 inches per hour) in the fine earth and rapid (more than 6 inches per hour) in the underlying sand and gravel. The available water capacity is 1.5 to 6 inches. Soil reaction is neutral to mildly alkaline. The organic matter is mostly medium or low in the surface layer, but it is high in some soils. Flooding may occur in places.

Within this mapping unit are a few small areas of wet soils, deep, well drained soils, and shallow, droughty, very gravelly soils.

Most areas of this mapping unit are used as native pasture having abundant shrubs and cottonwood or aspen trees. Others are mainly grasses or grasses and sedges.

H -- This mapping unit consists of poorly drained, saline soils that are more than 40 inches thick over sand and gravel. It is

nearly level, but the surface is mainly irregular. The surface and subsoil layers are mainly clay loam, although a few areas are loam or friable silty clay. These soils have more salinity in the upper 18 to 24 inches than below. There is a fluctuating water table between 30 and 60 inches during part of the year. Although some of the soluble salts are sodium salts, soil dispersion is only slight because the soil contains abundant lime. The soils are moderately alkaline.

Estimated permeability is moderately slow or slow (0.06 to 0.6 inches per hour). The available water capacity is 6 to 10 inches. Organic matter is low. Most of these soils are not subject to flooding or are only rarely flooded.

Within this mapping unit are a few very wet and slightly saline soils in narrow swales and old cut-off stream channels.

Most areas of this mapping unit are used for native range, but some are tame grass pasture.

P -- This mapping unit consists of areas of peat and muck soils that are more than 40 inches thick over alluvial deposits. They are poorly drained or very poorly drained soils with a water table within 30 to 60 inches of the surface for a major part of the growing season. There may be brief periods when water will be on the surface. The materials below 40 inches range from sand and gravel to compact silty clay.

The surface layer of these soils is mainly fibrous peat. The vegetation is sedges and rushes with scattered or dense growth of willows. Native pasture and occasional hay harvest are the uses of these soils.

R -- This mapping unit is reworked stream channel alluvium--mainly gravel and sand. These areas are frequently flooded and have little vegetative cover. Included are small areas that support grasses, shrubs, and cottonwood trees. Selected areas of these riverwash channels are used as a source of sand and gravel.

INTERPRETATIONS OF SOILS

Interpretations are given in the following table for a number of alternative uses. The ratings used are for the mapping unit as a whole and may not apply at a specific site within the mapping unit. More than one rating is given where soil properties overlap the rating criteria. The interpretations will not eliminate the need for on-site investigations and testing for specific design and construction. The interpretations can, however, be useful in general land use planning, in assessing hazards and development problems, in comparing different areas for a specific use, and in planning more detailed investigations at selected sites. Interpretations are based on the upper five feet of soil material in its natural state unless otherwise rated.

In the interpretation table, each soil is considered for the uses that may reasonably apply. For some of the uses, soil limitations are indicated by the ratings slight, moderate, and severe. Slight means soil properties generally are favorable for the use or, in other words, limitations are minor and easily overcome. Moderate means that some soil properties are unfavorable, but can be overcome or modified by special planning and design. Severe means soil properties are so unfavorable and difficult that to correct or overcome them

requires major soil reclamation or special design. For other uses, such as topsoil, suitability is rated by the terms good, fair, and poor, which have meanings approximately parallel to the terms slight, moderate, and severe. For other uses, no rating is given, but important soil features to be considered in planning, installation, or maintenance are listed. Where ratings of moderate, fair, severe, or poor are used, the main limiting features are given.

Following are explanations of the selected uses listed in the interpretation table:

Cropland--The limitations of soils for cropland are based on the capacity of the soil to produce, without excessive soil deterioration, economically acceptable yields of crops commonly grown in the area. Droughtiness, wetness, erosion hazard, workability, slope, and soil patterns are items considered in evaluating the soils for cropland.

Septic Tank Absorption Fields--Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage Lagoons--Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor. The sides, or embankments, are of soil material compacted to medium density. The pond is protected from flooding. Soil properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, depth to gravel, and slope. The soil properties that affect the embankment are the engineering properties of the embankment material that influence the ease of excavation and compaction.

Shallow Excavations--Shallow excavations are those that require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings--Dwellings, for which the soils are given limitation ratings, are those not more than three stories high and that are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for such dwellings are those that relate to capacity to support load and resist settlement under load. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, frost action potential,

and shrink-swell potential. Those that affect excavation are wetness, slope, and content of stones and rocks.

Sanitary Landfill--Sanitary landfill is a method of disposing of refuse in dug trenches or area fills. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, permeability, hazard of polluting ground water, and trafficability.

Local Roads and Streets--Local roads and streets for which soil ratings are given have an all-weather surface expected to carry automobile traffic. Roads and streets should have a subgrade consisting of gravel, crushed rock, or compacted soil material with a surface of gravel, asphalt, or concrete. They are graded to shed water and have provisions for drainage.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut-and-fill material available. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut-and-fill needed to reach an even grade.

Playgrounds--Playgrounds are areas to be used intensively for baseball, football, badminton, and for other similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistency that gives a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments. Soil suitability for growing vegetation is an important consideration.

Paths and Trails--Paths and trails include local and cross-country footpaths, trails, and bridle paths. It is assumed that these areas will be used as they occur in nature and that little or no soil will be moved (excavated or filled). Soil features that affect traffica-bility, dust, design, and maintenance are given special emphasis. These include soil texture, wetness, slope, and coarse fragments.

Picnic Areas--These are park type picnic areas. It is assumed that most vehicular traffic is confined to access roads. Suitability for growing vegetation is an important consideration.

Camp Areas--These are areas to be used intensively for tents and small camp trailers and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping or leveling for tents and parking areas. Soils should be suitable for heavy foot traffic and limited vehicular traffic. Suitability for growing vegetation is an important consideration.

Lawns and Landscaping--Soils are rated on the assumption that they will be used for lawn turf, shrubs, and trees without adding topsoil and also that irrigation will be provided.

Cemeteries--These are community type cemeteries. It is assumed that excavated topsoil will be used for turf establishment. Characteristics considered are water table, depth to hard rock, slope, soil texture, stoniness, and ease of excavation.

Road Fill--The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and Gravel--Sand and gravel are used in great quantities in many kinds of construction. The ratings provide guidance on where to discover probable sources. A soil is rated as a good or fair source if there is a layer of sand or gravel at least three feet thick within a depth of six feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate quality of the deposit.

Topsoil--Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed, natural fertility of the material, or the response of plants

when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is the damage that will result at the area from which topsoil is taken.

Pond Reservoir Areas--Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Dikes, Levees, and Embankments--Dikes, levees, and other embankments for retention of water require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage--Drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation--Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

TABLE 1

EAST GALLATIN FLOOD HAZARD STUDY

GALLATIN COUNTY, MONTANA

TABLE OF SOIL INTERPRETATIONS FOR SELECTED USES

Soil Symbol	Cropland	Septic Tank Absorption Fields	Sewage Lagoons	Sanitary Landfill: Trench Type	Sanitary Landfill: Area Type	Shallow Excavations	Dwellings With Basements	Dwellings Without Basements	Local Roads Streets and Parking Areas	Playgrounds	Paths and Trails	Picnic Areas and Campgrounds	Lawns and Landscaping	Road Fill	Sand & Gravel	Topsoil	Pond Reservoir Area	Dikes, Levees Embankments	Drainage	Irrigation
	Degree and Kind of Limitation For:										Suitability As a Source Of						Soil Features Affecting:			
A	Slight	1/ Slight or Moderate: moderate permeability. Severe: moderately slow permeability.	1/Slight: moderately slow permeability and more than 6 feet deep to gravel. Moderate: moderate permeability and more than 6 feet deep to gravel; or moderately slow permeability with gravel between 4 and 6 feet. Severe: moderate permeability with gravels at depths of less than 6 feet; or moderately slow permeability with gravels at depths of less than 4 feet.	1/Slight: moderate or moderately slow permeability to a depth of 10 feet or more and more than 6 feet to water table. Moderate: moderate or moderately slow permeability to depth of at least 6 feet with water table below 6 feet. Severe: rapidly permeable materials above 6 feet and/or with depth to water table less than 6 feet.	1/Slight: more than 6 feet to rapidly permeable gravel. Moderate: 4 to 6 feet to rapidly permeable gravel.	Slight: more than 60 inches to loose sand and gravel. Moderate: 40 to 60 inches to sand and gravel.	Severe: high frost action potential; low bearing capacity	Severe: high frost action potential.	Severe: high frost action potential; high compressibility; low bearing capacity.	Slight: less than 2% slopes with moderate permeability. Moderate: 2 to 6% slopes with moderately slow permeability. Severe: more than 6% slopes.	Slight or none.	Slight or none.	Slight or none.	Poor: high frost action potential; high compressibility; low bearing capacity.	Unsuited: local good sources below 40" depth.	Good	Permeability 0.2-2.0" per hr. Low resistance to piping.	Low resistance to piping; poor compaction characteristics; low shear strength; high frost action potential.	Permeability 0.2-2.0" per hr. Unstable ditch banks.	All features favorable.
B	Slight or Moderate: moderate available water capacity (4 to 8").	1/Slight	1/Severe: rapid permeability within 40 in.	1/Severe: less than 40 inches to rapidly permeable gravels.	1/Severe: less than 40 inches to rapidly permeable gravels.	Severe: less than 40 inches to loose sand and gravel; unstable side walls.	Slight or None.	Slight or None.	Slight.	Slight: less than 2% slopes. Moderate: 2 to 6% slopes. Severe: more than 6% slopes.	Slight or None.	Slight or None.	Slight or None.	Poor: 20 to 40"; high frost action potential; high compressibility. Good below 20 to 40".	Good for gravel; poor for sand.	Good	Rapidly permeable sand and gravel	Material below 20-40" is highly permeable when compacted.	All features favorable.	Available water capacity 4-8 inches.
C	Severe: low available water capacity (2 to 4 inches). Some areas are gravelly.	1/Slight	1/Severe: rapid permeability within 20 in.	1/Severe: less than 20 inches to rapidly permeable gravels.	1/Severe: less than 20 inches to rapidly permeable gravels.	Severe: less than 20" to loose sand and gravel.	Slight or None.	Slight or None.	Slight or None.	Slight: less than 2% slopes. Moderate: 2 to 6% slopes. Moderate where surface layer is gravelly loam.	Slight or None.	Slight or None.	Moderate: droughty soil less than 20" to gravel.	Good	Good for gravel; poor for sand.	Good: more than 16" to gravel. Fair: 10 to 16" to gravel. Poor: where surface is gravelly.	Rapidly permeable above 20".	Material below 20" highly permeable when compacted.	All features favorable.	Droughty soil; available water capacity of 2-4".
D	Moderate: seasonal water table at 30-60".	1/Moderate where depth to water table is more than 48". Severe where depth to water table less less than 48" or where subject to flooding.	1/Slight: moderately slow permeability with water table between 30 & 60 in. & more than 6 ft. to gravel. Moderate: moderate permeability with water table between 40 & 60 in., & more than 6 ft. to gravel or moderately slow permeability with water table between 40 & 60 in., and between 4 & 6 ft. to gravel. Severe: moderate permeability with water table above 40" & less than 6 ft. to gravel; moderately slow permeability with water table between 30 & 60" and less than 4' to gravel.	1/Severe: seasonal water table between 30 & 60 inches.	1/Moderate: 30 to 60 in. to seasonal water table.	Severe: high frost action potential; low bearing capacity.	Severe: high frost action potential; low bearing capacity; water table at 30-60". Severe where subject to flooding.	Severe: high frost action potential, low bearing capacity. Some flood hazard areas.	Severe: high frost action potential; high compressibility; some flood hazard areas.	Moderate: moderately slow permeability.	Slight or None.	Slight or None.	Slight or None.	Poor: high frost action potential; high compressibility; low bearing capacity.	Unsuited; local good sources below 40".	Good	Permeability 0.2-2.0" per hr.; water table at 30-60". Low resistance to piping.	Low resistance to piping; poor compaction characteristics; low shear strength; high frost action potential.	Permeability 0.2-2.0" per hr.; unstable ditch banks.	Water table between 30 & 60". Some flood hazard areas.

1/ Potential groundwater pollution hazard.

Estimated permeability rates: slow (0.06-0.20 in./hr.); moderately slow (0.20 to 0.60 in./hr.); moderate (0.6 to 2.0 in./hr.); rapid (more than 6.0 in./hr.).

EAST GALLATIN FLOOD HAZARD STUOY

GALLATIN COUNTY, MONTANA

TABLE 1 (Cont'd)

TABLE OF SOIL INTERPRETATIONS FOR SELECTED USES

Soil Symbol	Degree and Kind of Limitation For: Cropland	Septic Tank Absorption Fields	Sewage Lagoons	Sanitary Landfill: Trench Type	Sanitary Landfill: Area Type	Shallow Excavations	Dwellings With Basements	Dwellings Without Basements	Local Roads Streets and Parking Areas	Playgrounds	Paths and Trails	Picnic Areas and Campgrounds	Lawns and Landscaping	Suitability As a Source Of: Road Fill	Sand & Gravel	Topsoil	Soil Features Affecting: Pond Reservoir Area	Dikes, Levees Embankments	Drainage	Irrigation
E	Severe: too wet for crops; some flood hazard.	1/Severe: water table less than 30".	1/Severe: water table less than 30".	1/Severe: less than 30" to seasonal water table.	1/Severe: less than 30" to seasonal water table.	Severe: seasonal water table above 30".	Severe: high frost action potential; low bearing capacity; water table above 30"; some areas subject to flooding.	Severe: high frost action potential; low bearing capacity; some flood hazard areas; water table above 30".	Severe: less than 20" to water table; high frost action potential; high compressibility; low bearing capacity; some flood hazard areas.	Severe: less than 20" to water table; some flood hazard areas.	Moderate: less than 20" to water table; some flood hazard areas.	Severe: some flood hazard areas; mainly off-season.	Severe: poorly drained; some flood hazard areas.	Poor: less than 20" to water table; high frost action potential; high compressibility.	Unsuited: local good sources below 40".	Poor: less than 20" to water table.	Permeability 0.2-2.0" per hr. Water table within 30"; low resistance to piping.	Low shear strength; poor compaction characteristics; high frost action potential.	Permeability 0.2-2.0" per hr.; some flood hazard; poor outlets in places.	Water table above 20"; some flood hazard areas; needs drainage.
F	Moderate: droughty late in season; wet in spring; some flood hazard.	1/Moderate where depth to water table more than 48". Severe where depth to water table is less than 48".	1/Severe: rapid permeability within 40".	1/Severe: less than 40" to rapidly permeable gravel; less than 30" to seasonal water table.	1/Severe: less than 40" to rapidly permeable gravel; less than 30" to seasonal water table.	Severe: less than 40" to loose sand and gravel; unstable side walls; seasonal water table between 30" and 60".	Moderate: water table at 30-60"; severe where subject to flooding.	Slight: where seasonal water table below 40". Moderate: seasonal water table between 30 and 40".	Severe: high frost action potential; high compresaibility; seasonal water table between 30 and 60"; some flood hazard areas.	Slight: some flood hazard areas.	Slight: some flood hazard areas.	Slight	Slight or None	Poor: 20 to 40"; high compressibility; high frost action potential. Good below 20 or 40".	Good for gravel; poor for sand.	Good: surface is gravelly.	Rapidly permeable above 40".	Material below 20-40" highly permeable when compacted.	All features favorable.	Water table above 40" during growing season.
G	Moderate or Severe: droughty soil; flood hazard or gravelly soil.	1/Severe: water table less than 30".	1/Severe: rapid permeability within 40".	1/Severe: less than 40" to rapidly permeable gravel; less than 30" to seasonal water table.	1/Severe: less than 40" to rapidly permeable gravel; less than 30" to seasonal water table.	Severe: less than 30" to seasonal water table; gravel at 10-40"; unstable walls; some flood hazard.	Severe: less than 30" to water table; some areas subject to flooding.	Moderate: water table at 20-30". Severe: water table above 20" or where subject to flooding.	Slight or Moderate: low or moderate frost action potential; low or medium compresaibility; severe in flood hazard areas; seasonal water table.	Slight except moderate where surface layer is gravelly or in flood hazard areas.	Slight: some flood hazard areas.	Slight: some areas have flood hazard; mainly off-season.	Slight where soil is over 20"; moderate where less than 20" or in flood hazard areas.	Good below 10-40". Water table aeasonally limits excavation.	Good for gravel; poor for sand.	Good: more than 16" to gravel. Fair: 10-16" to gravel. Poor: less than 10" over gravel and gravelly surface soil.	Rapidly permeable above 40".	Materials below 10-40" highly permeable when compacted.	All features favorable except outlets may be difficult to locate.	Available water capacity of 2-8"; some gravelly soils.
H	Severe: moderate or high salinity.	Severe: moderately slow or slow permeabillty; water table 30-60".	Same as "0".	1/Severe: seasonal water table between 30-60".	1/Moderate: 30 to 60" to seasonal water table.	Moderate: seasonal water table at 30-60"; soil sticky when wet.	Severe: high frost action potential; low bearing capacity; water table between 30 and 60".	Severe: high frost action potential; low bearing capacity.	Severe: high frost action potential; low bearing capacity water table between 30 and 60".	Moderate: moderately slow or slow permeability clay loam surface layer sticky when wet; saline.	Moderate: clay loam surface layer sticky when wet.	Moderate: clay loam surface layer sticky when wet.	Moderate or Severe: moderate or high salinity; clay loam surface layer.	Poor: high frost action; high compressibility; low bearing capacity.	Unsuited: local good sources below 40".	Poor: poorly drained; moderate or high salinity.	Seasonal water table at 30-60"; saline shoreline; low resistance to piping.	Poor compaction characteristics; low shear strength; low resistance to piping; high frost action potential.	Permeability 0.06-0.6" per hr.; unstable ditch banks.	Moderate or high salinity; permeability 0.06-0.6" per hr.; drainage and reclamation needed.
P	Severe: too wet for crops.	1/Severe: water table less than 30".	1/Severe: highly organic; water table.	1/Severe: leas than 30" to seasonal water table.	1/Severe: less than 30" to seasonal water table.	Severe: less than 30" to water table.	Severe: water table within 30".	Severe: less than 30" to water table; very low bearing capacity.	Severe: poorly drained; very high compressibility; very low bearing capacity.	Severe: less than 20" to water table; very highly organic.	Severe: less than 20" to water table; organic soil.	Severe: less than 20" to water table; organic soil.	Severe: organic soil; water table.	Unsuited: highly organic.	Unsuited: local good sources below 40".	Poor: mainly fibrous peat.	Water table at 30-60".	Unsuited.	Fire hazard; excessive settlement; wind erosion hazard.	High water infiltration rate; drainage needed.
R	Severe: flood hazard; sand and gravel.	1/Severe: flood hazard.	1/Severe: rapidly permeable gravel.	1/Severe: subject to frequent flooding.	1/Severe: subject to frequent flooding.	Severc: flood hazard.	Severe: flood hazard.	Severe: flood hazard.	1/Severe: flood hazard; gravel and sand is hard to dig.	Severe: flood hazard.	Severe: flood hazard; sand and gravel.	Severe: flood hazard; gravel and sand.	Severe: flood hazard; sand and gravel.	Good: consider stream ecology and flood hazard.	Good: Consider stream ecology and flood hazard.	Unsuited: gravel and sand.	Rapidly permeable.	High compacted permeability.	Not applicable.	Not applicable.

1/ Potential groundwater pollution hazard.

Estimated permeability rates: slow (0.06-0.20 in./hr.); moderately slow (0.20 to 0.60 in./hr.); moderate (0.6 to 2.0 in./hr.); rapid (more than 6.0 in./hr.).

APPENDIX B

SUPPLEMENTARY TABLES

AND

BENCH MARK DOCUMENTATION

TABLE 2

FLOODPLAIN REFERENCE DATA

EAST GALLATIN RIVER

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
301	8+00	4912.7	4917.2	4917.7	4917.9	4918.2	N4°E
302	8+30	4911.7	4917.0	4917.5	4917.8	4918.0	N4°E
303	8+60	4911.2	4916.8	4917.3	4917.6	4917.8	N4°E
304	24+60	4898.2	4902.9	4903.3	4903.5	4904.5	North
305	54+60	4871.6	4877.2	4877.7	4878.0	4879.3	N5°W
306	74+60	4860.0	4867.9	4869.3	4869.9	4870.9	N21°E
307	100+60	4843.0	4850.0	4850.4	4850.5	4850.8	North
308	100+90	4841.9	4850.0	4850.4	4850.5	4850.8	North
309	101+20	4841.6	4848.8	4849.4	4849.7	4850.2	North
310	141+20	4825.0	4831.6	4832.1	4832.2	4832.3	N12°E
311	165+70	4811.1	4815.9	4816.3	4816.5	4816.7	N19°E
312	170+90	4804.5	4809.4	4809.9	4810.2	4810.7	N15°E
313	181+90	4795.3	4802.9	4803.2	4803.6	4804.7	N27°E
314	202+40	4781.8	4787.9	4789.3	4789.4	4789.6	N43°E

TABLE 2 (Cont'd)
FLOODPLAIN REFERENCE DATA
EAST GALLATIN RIVER

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
315	226+90	4766.9	4772.1	4772.5	4772.5	4772.6	N53°E
316	235+40	4756.0	4761.1	4762.3	4762.7	4763.5	N12°E
317	241+20	4745.9	4753.3	4754.6	4755.0	4755.9	N45°E
318	248+10	4742.2	4749.3	4750.3	4750.7	4751.5	N45°E
319	253+10	4737.7	4746.8	4747.2	4747.3	4747.3	N45°E
320	259+60	4736.8	4741.3	4741.5	4741.7	4742.0	N45°E
321	267+10	4732.9	4736.2	4736.8	4736.9	4737.4	N45°E
322	275+90	4722.5	4729.0	4730.5	4731.6	4733.2	N39°E
323	276+30	4722.6	4729.0	4730.5	4731.6	4733.2	N39°E
324	276+70	4720.7	4727.6	4728.8	4729.4	4730.7	N39°E
325	289+60	4714.3	4721.1	4722.0	4722.6	4723.9	N59°E
326	299+30	4711.1	4717.4	4719.2	4720.2	4722.2	East
327	299+70	4708.9	4717.4	4719.2	4720.2	4722.2	East
328	300+10	4710.3	4715.8	4716.5	4716.9	4717.7	East
329	315+60	4702.5	4707.7	4708.9	4709.5	4710.9	N50°E

TABLE 2 (Cont'd)
FLOODPLAIN REFERENCE DATA
EAST GALLATIN RIVER

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
330	316+00	4701.2	4707.7	4708.9	4709.5	4710.9	N50°E
331	316+40	4701.4	4706.9	4707.2	4707.4	4707.7	N50°E
332	407+40	4658.6	4669.7	4670.4	4670.6	4670.8	North
335	478+20	4642.1	4644.1	4644.1	4644.1	4644.1	N41°E
336	507+20	4623.7	4627.3	4627.6	4627.6	4627.8	N60°E
337	547+70	4609.5	4613.0	4613.0	4613.0	4613.0	North
340	658+50	4572.8	4576.5	4577.1	4577.3	4577.8	N54°E
341	723+50	4545.6	4549.8	4550.3	4550.5	4550.9	N54°E
342	809+30	4496.6	4503.1	4503.2	4503.2	4503.3	N39°E
343	895+50	4453.0	4459.0	4459.0	4459.0	4459.0	N39°E
346	957+90	4417.3	4421.3	4421.7	4421.9	4422.2	N63°E
347	1048+40	4384.4	4389.5	4390.5	4391.0	4392.1	East
348	1048+80	4380.1	4388.3	4388.5	4388.6	4389.2	East
349	1049+20	4383.9	4388.2	4388.5	4388.7	4388.9	East
350	1151+60	4344.8	4353.3	4354.0	4354.2	4354.3	N63°E
351	1212+70	4332.4	4337.6	4337.7	4337.7	4337.8	N43°E

TABLE 2 (Cont'd)
FLOODPLAIN REFERENCE DATA
EAST GALLATIN RIVER

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
352	1307+20	4316.6	4324.6	4325.3	4325.6	4325.9	North
353	1307+60	4316.6	4324.6	4325.3	4325.6	4325.9	North
354	1308+00	4315.3	4323.3	4323.3	4323.3	4323.3	North
355	1443+80	4295.1	4300.0	4300.3	4300.5	4300.7	N46°E
356	1632+70	4268.7	4276.4	4277.0	4277.2	4277.6	N69°E
357	1676+10	4262.5	4272.6	4273.3	4273.7	4274.0	North
358	1676+50	4260.9	4272.6	4273.3	4273.7	4274.0	North
359	1676+90	4261.2	4272.0	4272.6	4272.9	4273.4	North
360	1793+10	4243.0	4254.0	4254.8	4255.0	4255.0	N50°E
361	1856+90	4235.6	4242.0	4242.5	4242.7	4243.0	N73°E
362	1857+30	4235.5	4242.0	4242.5	4242.7	4243.0	N73°E
363	1857+70	4235.4	4241.6	4242.0	4242.1	4242.4	N73°E
364	1961+90	4216.3	4225.0	4225.5	4225.7	4226.1	North
365	1962+30	4216.0	4225.0	4225.5	4225.7	4226.1	North
366	1962+70	4215.7	4223.6	4224.2	4224.4	4224.7	North

TABLE 2 (Cont'd)
FLOODPLAIN REFERENCE DATA
EAST GALLATIN RIVER

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
367	2084+20	4196.6	4207.3	4207.8	4208.0	4208.3	North
368	2182+60	4184.8	4188.4	4188.9	4189.1	4189.4	North
369	2296+80	4167.7	4175.3	4176.1	4176.5	4177.1	North
370	2359+80	4156.8	4164.6	4165.6	4166.0	4166.9	North

TABLE 3

FLOODPLAIN REFERENCE DATA

BRIDGER CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
401	0+00	5267.5	5273.6	5274.2	5274.5	5275.0	West
402	13+62	5253.6	5257.8	5258.5	5258.8	5259.5	West
403	23+84	5236.1	5240.3	5240.5	5240.6	5240.8	West
404	25+54	5230.0	5234.1	5234.2	5234.3	5234.4	West
405	37+46	5208.1	5214.4	5215.0	5215.3	5215.8	West
406	51+08	5194.5	5201.4	5202.1	5202.4	5202.9	N76°W
407	71+52	5173.9	5175.9	5176.4	5176.6	5177.1	West
408	76+63	5157.8	5163.3	5164.1	5164.4	5165.1	West
409	81+74	5149.2	5157.7	5157.7	5157.7	5157.7	West
410	82+24	5149.3	5157.2	5157.3	5157.3	5157.3	West
411	82+74	5149.3	5154.8	5155.3	5155.3	5155.5	West
412	109+99	5114.8	5119.4	5119.8	5120.0	5120.4	West
413	121+91	5104.0	5108.6	5109.2	5109.4	5110.1	N37°W
414	144+05	5076.8	5082.1	5082.7	5083.2	5083.9	N47°W

TABLE 3 (Cont'd)
FLOODPLAIN REFERENCE DATA
BRIDGER CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
415	161+08	5060.8	5066.4	5066.5	5066.5	5066.6	North
416	161+58	5059.6	5066.2	5066.3	5066.4	5066.4	North
417	162+08	5059.7	5065.8	5066.2	5066.2	5066.3	North
418	196+14	5020.5	5025.5	5027.0	5027.7	5028.8	North
419	196+64	5020.3	5025.1	5026.4	5026.9	5028.2	North
420	197+14	5016.8	5022.7	5023.1	5023.5	5024.1	North
421	227+80	4999.8	5005.7	5005.9	5006.0	5006.2	N3°W
422	228+30	4999.4	5005.5	5005.6	5005.7	5006.0	N3°W
423	228+80	4999.5	5003.7	5004.2	5004.3	5004.7	N3°W
424	242+43	4993.8	4999.1	4999.6	4999.9	5000.4	N30°W
425	274+79	4984.0	4989.9	4990.5	4990.9	4991.8	N24°W
426	285+01	4980.3	4985.6	4986.7	4987.2	4988.3	N2°E
427	302+04	4955.4	4960.4	4961.4	4961.9	4962.8	N47°E
428	317+37	4936.3	4942.4	4943.6	4944.0	4945.0	N57°E
429	327+99	4904.2	4915.0	4915.5	4916.2	4917.2	N5°W

TABLE 3 (Cont'd)
FLOODPLAIN REFERENCE DATA
BRIDGER CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
430	332+70	4893.6	4902.6	4903.4	4903.4	4904.5	N83°W
431	341+22	4874.5	4880.3	4881.1	4881.2	4881.9	N47°W
432	349+74	4859.2	4863.7	4864.5	4865.0	4865.7	N60°W
433	356+56	4851.6	4854.3	4854.7	4854.9	4855.4	N14°W
434	383+81	4816.3	4820.6	4821.1	4821.3	4821.6	N1°E
435	407+65	4800.6	4805.1	4806.0	4806.4	4807.4	N3°E
436	416+17	4788.6	4793.0	4793.8	4794.3	4795.5	N17°W
437	416+67	4787.1	4792.2	4792.8	4793.2	4793.9	N17°W
438	417+17	4787.2	4791.3	4791.7	4791.9	4792.3	N17°W
439	439+31	4767.3	4773.3	4774.3	4774.7	4775.1	N4°E
440	463+15	4738.3	4747.1	4748.5	4749.1	4749.6	N1°E
441	481+88	4721.3	4727.0	4727.3	4727.4	4727.6	North
442	482+38	4721.5	4725.5	4726.9	4727.3	4727.6	North
443	482+88	4721.6	4725.7	4726.0	4726.3	4726.7	North

TABLE 4

FLOODPLAIN REFERENCE DATA

BOZEMAN CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
1	0+00	5163.4	5169.8	5171.1	5171.7	5173.4	East
2	0+50	5163.2	5169.3	5170.3	5170.7	5171.7	East
3	1+00	5161.2	5167.7	5168.2	5168.2	5168.2	East
4	35+06	5118.8	5124.3	5124.7	5125.0	5125.4	East
5	64+01	5081.8	5086.3	5086.9	5087.2	5088.0	East
5.5	84+45	5056.9	5061.5	5061.6	5061.7	5061.9	East
6	94+67	5044.0	5048.4	5048.7	5048.9	5049.3	East
7	125+33	5007.1	5012.0	5012.2	5012.3	5012.5	East
8	125+93	5005.5	5012.0	5012.2	5012.3	5012.5	East
9	126+53	5005.5	5011.0	5011.0	5011.1	5011.1	East
10	153+78	4973.1	4977.7	4978.6	4979.0	4979.1	East
11	187+84	4936.6	4941.2	4941.4	4941.6	4942.0	East
12	216+79	4901.4	4907.4	4908.0	4908.3	4908.9	East

TABLE 4 (Cont'd)
FLOODPLAIN REFERENCE DATA
BOZEMAN CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
13	220+20	4898.2	4906.2	4907.1	4907.4	4908.0	East
14	227+01	4894.8	4899.1	4899.6	4899.8	4900.0	East
15	231+26	4885.6	4890.3	4890.8	4891.1	4891.6	East
16	235+48	4884.6	4888.9	4889.4	4889.7	4890.0	East
20	247+40	4871.1	4877.7	4878.6	4878.9	4879.5	East
21	252+50	4868.0	4872.8	4873.3	4873.5	4874.1	East
22	255+91	4862.3	4866.7	4867.0	4867.2	4867.6	East
23	264+43	4855.1	4860.1	4860.5	4860.7	4861.2	East
24	272+95	4846.3	4852.1	4852.2	4852.2	4852.4	East
25	278+06	4840.9	4846.0	4846.4	4846.6	4846.9	East
26	292+00	4826.9	4830.9	4831.6	4831.9	4832.1	East
27	298+00	4817.9	4823.6	4824.0	4824.1	4824.3	East
28	300+20	4813.6	4818.1	4818.4	4818.5	4818.6	East
29	307+01	4806.5	4810.5	4810.6	4810.6	4810.6	East

TABLE 4 (Cont'd)
FLOODPLAIN REFERENCE DATA
BOZEMAN CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
30	310+42	4800.9	4808.7	4808.9	4808.9	4808.9	East
31	313+83	4795.3	4801.4	4801.8	4801.8	4801.8	East
32	317+24	4793.4	4796.2	4796.4	4796.4	4796.4	East
33	320+65	4787.5	4791.1	4791.3	4791.3	4791.3	East
34	325+76	4781.6	4789.0	4789.2	4789.2	4789.2	East
35	334+28	4774.5	4780.5	4780.8	4780.8	4780.8	East
36	339+39	4770.8	4776.8	4776.8	4776.8	4776.8	East
37	342+80	4766.8	4771.3	4771.3	4771.3	4771.3	East
38	346+21	4761.8	4767.5	4767.5	4767.5	4767.5	East
39	349+62	4756.3	4761.4	4761.4	4761.4	4761.4	East
40	361+54	4739.6	4744.6	4744.6	4744.6	4744.6	N70°W
41	375+86	4724.9	4728.0	4728.0	4728.0	4728.0	N65°E
42	392+89	4705.9	4711.8	4712.7	4713.2	4714.2	N65°E

TABLE 5

FLOODPLAIN REFERENCE DATA

EAST OVERFLOW CHANNEL IN BOZEMAN

FOR

BOZEMAN CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
25.1	0+00	4832.2	4835.7	4836.2	4836.7	4836.9	East
26	6+00	4827.5	4834.0	4834.2	4834.4	4834.6	East
27	14+00	4820.7	4824.8	4825.2	4825.7	4826.9	East
28	19+00	4813.2	4815.8	4816.2	4816.4	4817.6	East
29	23+00	4803.4	4807.4	4807.9	4808.2	4809.6	East
30	28+00	4798.2	4800.8	4802.4	4804.5	4804.5	East
31	34+00	4793.4	4800.3	4802.1	4802.6	4803.1	East
32	37+00	4789.6	4794.7	4796.6	4796.9	4797.3	East
33	39+00	4783.4	4787.9	4788.9	4789.4	4790.0	East
34	43+00	4780.1	4782.8	4784.1	4784.7	4785.9	East

(Channel not studied beyond this point.)

TABLE 6

FLOODPLAIN REFERENCE DATA

BEAR CANYON CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
101	0+00	5142.2	5149.0	4149.5	5149.8	4150.1	East
102	18+00	5111.8	5115.5	5116.3	5116.6	5117.2	East
103	34+00	5081.9	5086.1	5086.5	5086.6	5086.7	N85°E
104	48+00	5063.3	5066.1	5066.8	5067.1	5067.8	N80°E
105	64+00	5046.1	5049.2	5049.9	5050.1	5050.7	N80°E
106	83+00	5019.4	5024.4	5024.5	5024.5	5024.6	N73°E
107	97+00	5005.2	5010.3	5010.5	5010.5	5010.8	N85°E
108	118+00	4992.4	4996.7	4997.6	4997.9	4998.6	East
109	118+30	4992.4	4996.4	4997.0	4997.3	4997.7	East
110	118+60	4992.1	4995.1	4995.1	4995.1	4995.1	East
111	134+60	4966.9	4972.0	4972.4	4972.6	4972.8	East
112	149+60	4949.2	4953.9	4954.6	4954.9	4956.0	East
113	153+60	4937.9	4941.2	4942.4	4942.9	4943.9	N71°W
114	157+60	4934.1	4939.1	4939.1	4939.1	4939.1	N71°W

TABLE 7

FLOODPLAIN REFERENCE DATA

ROCKY CREEK

Surveyed Cross-Section Number	Channel Distance Stationing	Stream Bed Elevation ft. M.S.L.	10-Year Flood Elevation ft. M.S.L.	50-Year Flood Elevation ft. M.S.L.	100-Year Flood Elevation ft. M.S.L.	500-Year Flood Elevation ft. M.S.L.	Approximate Bearing of Section
201	0+00	5006.9	5012.4	5013.3	5013.7	5014.3	N48°E
202	11+00	4996.8	5000.1	5000.5	5000.8	5001.3	N61°E
203	25+00	4982.3	4987.1	4987.8	4988.2	4988.8	N44°E
204	41+00	4967.3	4974.0	4975.3	4975.5	4975.9	N51°E
205	41+40	4967.3	4974.0	4975.3	4975.5	4975.9	N51°E
206	41+80	4967.7	4972.8	4973.5	4973.7	4974.3	N51°E
207	55+80	4958.3	4961.9	4962.5	4962.7	4963.1	N76°E
208	85+80	4938.4	4944.7	4945.5	4945.8	4946.3	N56°E
209	100+80	4923.5	4926.6	4927.3	4927.6	4928.2	N73°E

TABLE 8

BRIDGES ACROSS EAST GALLATIN RIVER

Cross Section Number	River Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
302	8+30	Kelley Canyon Cutoff	4912.7	4920.1	4917.5	4917.8	4918.3	0.5	
305	54+60	Kelley Canyon Road	4871.6	4879.0	4877.7	4878.0	4877.2		0.8
308	100+90	Private Road	4841.9	4851.2	4850.4	4850.5	4849.7		0.8
313	181+90		4794.8	4804.3	4803.2	4803.6	4802.3		1.3
323	276+30	On "L" Street	4722.6	4734.7	4830.5	4831.6	4733.3	1.7	
327	299+70	Stock Yards Street	4708.9	4718.5	4719.2	4720.2	4717.0		3.2
330	316+00	Bridger Dr.	4701.2	4714.6	4708.9	4709.5	4712.4	2.9	
332	407+30	Todd-Stevens Road	4658.6	4674.9	4670.4	4670.6	4673.2	2.6	
337	547+70	Spring Hill Rd.	4609.5	4618.2	4613.0	4613.0	4615.6	2.6	
348	1048+80	Penwell Road	4380.1	4392.6	4688.5	4688.6	4390.6	2.0	
350	1151+60	Angel Road	4344.8	4354.1	4354.0	4354.2	4352.1		2.1
353	1307+60	Belgrade North Road	4316.6	4328.0	4325.3	4325.6	4326.0	0.4	

TABLE 8 (Cont'd)
BRIDGES ACROSS EAST GALLATIN RIVER

Cross Section Number	River Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
358	1676+50	Swamp Road	4260.9	4274.7	4273.3	4273.7	4272.5		1.2
360	1793+10	Old Dry Creek Manhattan Rd.	4243.0	4255.5	4254.8	4255.0	4251.5		3.5
362	1857+30	Paved Dry Creek Manhattan Rd.	4235.5	4248.5	4242.5	4242.7	4244.3	1.6	
365	1962+30	Spaulding Rd.	4216.0	4226.4	4225.5	4225.7	4225.0		0.7

TABLE 9

BRIDGES ACROSS BRIDGER CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
404	25+54	Bridger Canyon Cutoff Road	5230.0	5244.9	5234.2	5234.3	5241.1	6.8	
410	82+24	Private Road centerline Sec. 30, T1S, R7E	5149.2	5157.3	5157.3	5157.3	5155.3		2.0
412	109+99	On private road between 30 & 31, T1S, R7E	5114.8	5119.6	5119.8	5120.0	5118.0		2.0
416	161+58	Private road between Sec. 31 & 36	5059.7	5066.8	5066.3	5066.4	5065.2		1.2
419	196+64	Kelley Canyon Rd.	5020.3	5030.6	5026.4	5026.9	5028.5	1.6	
422	228+30	Private Road Jake Mast Farm	4999.4	5005.9	5005.6	5005.7	5004.4		1.3
427	302+04	40' downstream from USGS gage	4955.4	4960.8	4961.4	4961.9	4959.0		2.9
429	327+59	14' diameter culvert under highway	4904.2	4933.2	4915.8	4916.2	4918.2	2.0	

TABLE 9 (Cont'd)
BRIDGES ACROSS BRIDGER CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
430	332+70	8.5' x 16' CMP arch under highway culvert	4893.6	4907.0	4903.4	4903.4	4895.1		8.3
432	349+74	At Fish Hatchery	4859.2	4667.9	4864.5	4865.0	4865.8	0.8	
437	416+67	Bridger Canyon Highway	4787.1	4798.1	4792.8	4793.2	4795.9	2.7	
442	482+38	Blueberry Hill Road	4722.4	4728.1	4726.9	4727.3	4726.1		1.2

TABLE 10

BRIDGES ACROSS BOZEMAN CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
2	0+50	Leverich School Road	5163.2	5172.1	5170.3	5170.7	5170.7	0	
8	125+93	Goldenstein Rd.	5005.5	5012.6	5012.2	5012.3	5010.6		1.7
13	220+20	Kagy Lane	4898.2	4909.4	4907.1	4907.4	4907.4		0
20	247+40	Farm Bridge	4871.1	4876.3	4878.6	4878.9	4875.3		3.6
24	272+95	Ice Pond Road	4846.3	4853.6	4852.2	4852.2	4852.0		0.2
25.2	282+97	R.R. Bridge	4831.3	4842.6	4836.5	4836.5	4840.0	3.5	
28.2	300+20	Olive Street	4807.5	4816.0	4814.2	4814.2	4813.0		1.2
29	307+01	Rouse Street	4806.6	4812.2	4810.6	4810.6	4810.7	0.1	
30	310+42	Alley S of Main	4800.9	4807.7	4808.9	4808.9	4806.7		2.2
31	313+83	Alley N of Main	4795.3	4803.4	4801.8	4801.8	4802.4	0.6	
36	339+39	Peach Street	4770.8	4777.4	4776.8	4776.8	4776.2		0.6
39	349+62	E. Tamarack St.	4756.3	4763.6	4761.4	4761.4	4762.3	0.9	
40	361+54	2-10.5' diameter CMP I-90	4739.6	4775.0	4744.6	4744.6	4750.0	5.4	
42	392+89	Stockyard Rd.	4705.9	4713.3	4712.7	4713.2	4711.6		1.6

TABLE 11

BRIDGES ACROSS EAST OVERFLOW CHANNEL

IN BOZEMAN FOR BOZEMAN CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.		
								Above	Below
Between 26 & 27	7+00	2-40" R.C.P. under South Church Ave.	4828.8	4834.3	4832.5	4833.0	4832.3		0.7
Between 30 & 31	31+00	5.7 x 10' arch concrete culvert under E. Main	4796.3	4804.3	4802.5	4804.5	4802.0		2.5
Between 32 & 33	38+00	Wooden bridge on E. Lamme	4788.9	4795.7	4796.5	4796.7	4794.0		2.7

TABLE 12

BRIDGES ACROSS BEAR CANYON CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
101	0+00	Farm Bridge	5142.2	5148.0	5149.5	5149.8	5146.9		2.9
102	18+00	Farm Bridge	5111.8	5117.4	5116.3	5116.6	5116.2		0.4
104	48+00	Farm Bridge	5063.3	5067.1	5066.8	5067.1	5065.9		1.2
109	118+30	Academy Road	4992.4	4998.5	4997.0	4997.3	4996.9		0.4
111	134+60	Old Fort Ellis School Road	4966.9	4974.2	4972.4	4972.6	4973.2	0.6	

TABLE 13

BRIDGE ACROSS ROCKY CREEK

Cross Section Number	Channel Stationing	Identification	Stream Bed Elev. (ft.) M.S.L.	Bridge Deck Elev. (ft.) M.S.L.	50-Year Flood Crest Elev. (ft.) M.S.L.	100-Year Flood Crest Elev. (ft.) M.S.L.	Bridge Underclearance Relation 100-Year Flood Elev. (ft.) M.S.L.	Above	Below
205	41+40	Moffit Canyon Road	4967.3	4974.9	4975.3	4975.5	4973.5		2.0

TABLE 14
EAST GALLATIN FLOOD HAZARD STUDY
COAST AND GEODETIC SURVEY BENCH MARKS
(Used for this study)

Bench Mark No. U-492
Elevation: 4,978.10
Description: About 4.85 miles southeast along the Northern Pacific Railway from the station at Bozeman, in section 23, T 2 S, R 6 E, 16 poles southeast of milepost 136, in the top of the southwest end of the southeast concrete abutment of bridge number 135, 3-1/2 rails southeast of a road crossing, 19 feet southwest of the southwest rail, and about 1 foot below the level of the track.

Bench Mark No. V-492
Elevation: 5,026.256
Description: About 5.6 miles southeast along the Northern Pacific Railway from the station at Bozeman, in section 24, T 2 S, R 6 E, 6 poles southeast of milepost 135, 84 feet southwest of the southwest rail, 80 feet northeast of the center line of U. S. Highway 10, 6 feet northeast of a power pole, 2 feet southeast of a white wooden witness post, about 2 feet below the level of the track, about level with the highway, and in the top of a concrete post projecting 4 inches.

Bench Mark No. H-102
Elevation: 4,939.003
Description: About 4.1 miles southeast along the Northern Pacific Railway from the station at Bozeman, in section 14, T 2 S, R 6 E, 27 poles southeast of milepost 137, in the top of the southwest end of the southeast concrete abutment of bridge number 136 over Bear Creek, 19 feet southwest of the southwest rail, and about 2 feet below the level of the track.

Bench Mark No. P-492
Elevation: 4,768.560
Description: At Bozeman, along the Northern Pacific Railway, at the station, in section 6, T 2 S, R 6 E, set vertically in the northeast face of the station and midway between 2 ticket office windows, 26 feet southwest of the main track, and about 2-1/2 feet above the platform.

Bench Mark No. C-493
Elevation: 4,651.474
Description: About 2.65 miles northwest along the Northern Pacific Railway from the station at Bozeman, in section 26, T 1 S. R 5 E, 4-1/2 poles northwest of milepost 143, in the top of the southeast end of the southwest stone head wall of a 5-foot arch culvert, 5-1/2 rails southeast of a road crossing, 16 feet southwest of the southwest rail, and about 4 feet below the level of the track.

TABLE 14 (Cont'd)

Bench Mark No. Q-4
Elevation: 4,600.919
Description: About 4.15 miles northwewt along the Northern Pacific Railway from the station at Bozeman, in section 27, T 1 S, R 5 E, 23-1/2 poles northwest of milepost 144, 45 feet southwest of the southwest rail, 109 feet west of the center of a road crossing, 24 feet north-northwest of the center line of the road, 2 feet southeast of a white wooden witness post, about 3 feet above the level of the track, and on the top of a 3-inch iron pipe which projects 3 inches. *"Q 4 1907" was stamped by this party.

Bench Mark No. J-493
Elevation: 4,453.275
Description: About 0.9 mile southeast along the Northern Pacific Railway from the station at Belgrade, thence 0.6 mile north-northeast along Airport Road, at Gallatin Field, in section 6, T 1 S, R 5 E, in the top of the concrete foundation of first hangar southeast of the administration building, 8 inches west of the northwest corner of the hangar, and about flush with the ground.

Bench Mark No. K-4
Elevation: 4,243.157
Description: At Manhattan, at the east corner of the intersection of South Railroad and Broadway Streets, in the top of the sidewalk leading to the War Memorial Plaque, 6-1/2 feet west of the plaque, 1 foot west of a drinking fountain, and about flush with the ground.

TABLE 15

EAST GALLATIN FLOOD HAZARD STUDY

TBM DESCRIPTIONS FOR EAST GALLATIN RIVER

TBM No. 1/	MSL 2/ Elevation	Description
EG 1	4933.32	Wooden hub 30' N. of RR, E shoulder county road, first road crossing RR below Bear Creek RR bridge. SE SW NW, Sec. 14, T2S, R6E.
EG 2	4922.69	Steel pin, 70' W of mail boxes, near fence corner post at intersection of county roads.
EG 3	4899.39	Steel pin 75' W of gate in National Guard rifle range, base power pole with guide wire.
EG 4	4882.04	Wooden hub 50' SW transformer pole 40' S of M. S. Michail mail box, S. borrow pit of county road.
EG 5	4871.69	Wooden hub 40' S. RR track, base telephone pole #36G.
EG 39	4638.84	On top nut on power pole base on north side of old Highway 10 at intersection with Springhill Road. SW SW, Sec. 25, T1S, R5E.
EG 40	4618.22	On SW corner of E. Gallatin bridge on Springhill Road. NW, Sec. 26, T1S, R5E.
EG 42	4601.60	On top of steel grain bin; hold-down clamp on west side of bin, 600' south of SE corner, Sec. 22, T1S, R5E.
EG 43	4589.08	On RR spike in 6th telephone pole north of highway on west side of county road along east boundary Sec. 15, T1S, R5E.
EG 44	4552.16	On 1x2 stake by west gate post on north side of county road where road turns west--¼ mile north of SE corner, Sec. 15, T1S, R5E.
EG 45	4540.44	On top of 2" iron pipe by post farthest west in front of concrete block house. Approximately ½ mile west of TBM EG 44.
EG 46	4519.57	On broken fence post on NE side county road 20' SE of corner where road turns north--SE, Sec. 15, T1S, R5E.
EG 47	4512.96	On east end of CMP under county road 75' north of Dale Williams driveway ¼ mile east of NW corner Sec. 15, T1S, R5E.

TABLE 15 (Cont'd)
TBM DESCRIPTIONS FOR EAST GALLATIN RIVER

TBM No.	MSL Elevation	Description
EG 48	4492.28	On top of 8" well casing at ¼ corner between Sec. 9 and 16, T1S, R5E--county road turns north.
EG 49	4477.04	On south end of west headwall of concrete structure for road crossing W. Fork of E. Gallatin R. Center of Sec. 9, T1S, R5E.
EG 50	4464.93	SE corner of west headwall of pipe crossing old railroad bed at ¼ corner Secs. 4 and 9, T1S, R5E.
EG 51	4453.86	On short railroad tie post, west side Tom Ross mail box.
EG 52	4453.95	On top of south end of 24" CMP where county road turns NW parallel to airport runway along south boundary Sec. 5, T1S, R5E.
EG 53	4437.49	On steel pin by red and white fence post on west side of road at approximately ¼ corner between Secs 5 and 6, T1S, R5E.
EG 54	4417.55	On top of south end CMP under E-W road at intersection on Sec. corner. 30 | 31 / 6 | 5 T1S, R5E.
EG 55	4398.80	On black rock painted red on west side of road in center of rock cluster where old RR grade crossed county road N. of ¼ cor. Secs 36 and 31, T1N, R4E R5E.
EG 56	4386.79	On base of corner post at SE corner of road intersection at section corner. 25 | 30 / 36 | 31 T1N; R4E R5E
EG 57	4377.53	On iron pipe set by black tie gate post on north side of road. Second corner going east from section corner. 25 | 30 / 36 | 31
EG 58	4385.35	On bottom bolt on power pole on east side of county road at highway intersection at ¼ corner of Sec. 25 and 36--1½ mi. north of Belgrade.
EG 59	4355.78	On hub nailed to power pole NE corner of county road and highway intersection, second county road north of Belgrade.
EG 60	4352.88	On stake nailed to power pole on east side of highway where highway heads due north--approx. 3¼ mi. N of Belgrade. At sec. cor. 24 | 19 / 25 | 30 T1N; R4E R5E

TABLE 15 (Cont'd)
TBM DESCRIPTIONS FOR EAST GALLATIN RIVER

TBM No.	MSL Elevation	Description
EG 61	4328.81	On 2nd rail bolt on SE cor. east edge of bridge. First bridge N of Milesnick farmstead--near ¼ corner of 13 and 18, T1N, R4E-R5E.
EG 62	4318.51	On top of bolt head on bridge deck rail on SW cor. of highway bridge over Smith Creek--N¼ corner between 13 and 18, T1N, R4E-R5E.
EG 63	4304.84	On railroad spike on east side of east rail about 1,000 ft. NW of highway curve.
EG 64	4295.06	On top of large rock on east side of RR tracks over culvert ½ mi. N of point where highway crosses RR.
EG 65	4301.36	Top of north R.O.W. marker on SW cor. of first county road intersection west of Dry Creek Church on highway to Manhattan; at sec. cor. 34 35 T2N R4E / 3 2 T1N
EG 66	4273.91	On RR spike in transformer pole for Dry Creek School.
EG 67	4246.26	On top west edge of NE wing wall on highway bridge across E. Gallatin R.--highway from Dry Creek to Manhattan--near sec. line between secs. 3 & 4, T1N, R4E.
EG 68	4238.78	On RR spike in ground on N side of fence corner post, NE corner of county road intersection 200' W of highway curve.
EG 69	4231.68	On head of RR spike in east tie gate post on west side of county road at intersection of first road going north after leaving pavement--on east line Sec. 5, T1N, R4E.
EG 70	4223.82	On RR spike in corner fence post on east side of road at sec. cor. 31 32 T1N / ½ mi. west EG 69 6 5 T2N R4E
EG 71	4211.16	On RR spike in the RR tie post east side of road at cor. of road ½ mi. W of EG 70; NW Cor. Sec. 6, T1N, R4E.
EG 72	4198.27	On spike in fence post approx. 3/4 mi. N of EG 71.
EG 73	4180.38	On south end of east headwall of old bridge approx. 1 mile west of EG 72.

TABLE 15 (Cont'd)
TBM DESCRIPTIONS FOR EAST GALLATIN RIVER

TBM No.	MSL Elevation	Description
EG 74	4229.49	On west end of CMP under county road running north from pavement 1 mile south of TBM EG 71, 2 miles east of Manhattan.
EG 75	4161.89	On top of rebar for bridge girder plate on SW wind of bridge across the Gallatin--north of Manhattan north of section line between sections 27 and 34, T2N, R3E.
EG 76	4226.52	On bolt in power pole base in front of farmstead on west side of county road approximately 3/8 mi. N of Manhattan, Sec. 3, T1N, R3E.

1/ Temporary Bench Mark (TBM); East Gallatin (EG)

2/ Mean Sea Level (MSL)

TABLE 16

EAST GALLATIN FLOOD HAZARD STUDY

TBM DESCRIPTIONS FOR BRIDGER CREEK

TBM No.	MSL Elevation	Description
BR 1 [1/]	4735.55	Steel pin at corner of fence near driveway; 15' NE C. R. France's mail box.
BR 2	4730.00	Steel pin 12' W of RR crossing sign next to whistle post; 25' N of stockyard fence.
BR 3	4760.70	Steel pin 50' across highway at Moshier mail box.
BR 3-1	4830.20	Spike head on inside of E rail 48' S and across road from RR sign.
BR 4	4786.33	Top of culvert (24"), E side highway.
BR 5	4825.07	Steel pin under guy wire, 10' from power pole, ½ mi. uphill from bridge over Bridger Creek, S side highway. Sec. 33, T1S, R6E
BR 6	4923.35	Steel pin 75' S of Huffine School; 100' E of "Fish Culture" sign.
BR 7	4945.58	Steel pin at fence corner 75' S of highway 150' NE of bridge over Bridger Creek on old road.
BR 8	4998.52	On post E end guard rail W edge Kramer approach road.
BR 9	5021.14	On bolt, N end of Malti Plate Cattle Pass.
BR 10	5022.22	Steel pin 10' N of Lloyd Moats mail box.
BR 11	5068.68	Steel pin near power pole, 100' SE 7-L mail box, 50' S driveway gate, 250' new log house.
BR 12	5122.30	Steel pin 75' N of D. Holt driveway, 25' SE of highway bridge, 4' S of power pole with transformer.

TABLE 16 (Cont'd)
TBM DESCRIPTIONS FOR BRIDGER CREEK

TBM No.	MSL Elevation	Description
BR 13	5163.82	Steel pin 50' S of E-W section line, 200' N of log house along pole fence, 2' W of con. marker FAS 3700.
BR 14	5266.89	Steel pin 9' W of power pole, 40' W of highway, 400' W old school, 100' S intersection county road and secondary road 293.
BR 15	5283.67	Top of outlet CMP under secondary road 293, 150' NE of Dr. Hubbel mail box, due E of house.
BR 16	5327.92	Steel pin 15' W of highway 293 near power pole, 50' SW of M. A. Buck mail box, 200' S of Bridger Cr. bridge, 10' E of metal gate.
BR 17	4895.81	On RR spike in post holding slide area sign below slide area at mouth of Bridger Canyon.
BR 18	4718.86	Bolt head 4.5' NE of SW corner of steel bridge over E. Gallatin, on wooden rail of deck.

1/ Bridger Creek (BR)

TABLE 17
EAST GALLATIN FLOOD HAZARD STUDY
TBM DESCRIPTIONS FOR BOZEMAN CREEK

TBM No.	MSL Elevation	Description
BO 1 [1/]	4789.04	Set on corner of sidewalk on SW corner of intersection at E. Davis and E. Plum; painted red.
TP	4803.77	Top of fire plug housing east edge SW corner Wallace and Mendenhall.
TP	4808.68	Top of fire plug NE corner of Wallace and E. Main.
BO 2	4823.58	RR spike in power pole on west side of south end of Wallace Avenue.
BO 3	4832.55	Top of fire plug on northeast top housing bolt--intersection E. Story and S. Church.
BO 4	4850.49	On south end of middle rail on W side of street, 2nd creek crossing up S. Church across street from red apartments.
BO 5	4866.79	Top of yellow steel post on SW corner of Martel Construction Co. driveway.
BO 6	4883.75	On large concrete block by post on south side of Frank Baltz driveway, 1507 S. Church
BO 7	4943.30	On spike in NE side of power pole on SW corner of intersection of S. Church and Kagy Lane.
BO 7 1	4908.70	NE corner of E cross-member 12" by 12" wood beam on Kagy Lane bridge over Bozeman Creek.
BO 7 3	4908.70	On top of steel post holding slow danger sign on east side of west drive entrance to Valley View Club.
BO 8	4966.03	On a ¼" x 3" steel plate over end of concrete wall under Dr. Schumacher mail box on S. Church.
BO 8 1	4944.87	On N side of tie gate post 50' W of transformer pole on NW corner of Schumacher property.
BO 9	5055.08	On top of 3/4" pipe by tie gate post on south side of entrance road to R. J. Roethle place at intersection of Sourdough Road.

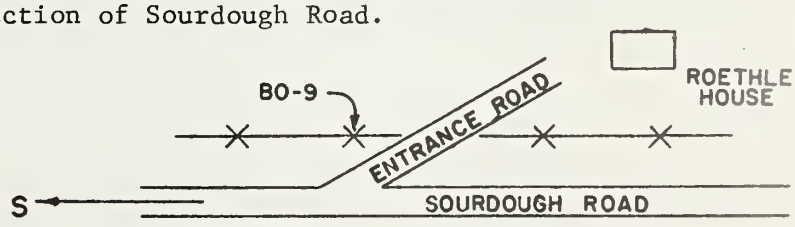


TABLE 17 (Cont'd)
TBM DESCRIPTIONS FOR BOZEMAN CREEK

TBM No.	MSL Elevation	Description
BO 9 1	4977.82	East side of creek ½ mi. west of Svenrude house.
BO 10	5086.71	On concrete headwall on east side of road north side driveway to Bouma residence.
BO 10-1	5011.80	NE cor. of N center pier of bridge on Bozeman Cr. on Goldenstein Road N boundary Sec. 30, T2S, R5E.
BO 11	5138.39	First power pole south or transformer pole for T. C. Kartes farmstead.
BO 12	5181.00	On ½" rod by fence on west side of Sourdough Rd. directly west of H. E. Fechter's driveway.
BO 13	5212.72	On ½" rebar set 2' west of corner fence post on NW cor. of road intersection where Sourdough Rd. turns west.
BO 14	5146.70	On ½" rebar by south tie gate post west side of road one mile N of Leverich School.
BO 15	5097.70	On ½" rebar on SE cor. of intersection by tie cor. post across road E of driveway to H.J. Klumph or on west side of driveway to farmstead ¼ mile east.
BO 16	5071.89	On W side of RR switch control on spike head first crossing N of Leverich School on West 3rd Avenue.
BO 17	5047.65	On east end of R.C.P. under RR in front or N of Goldenstein Brothers house.
BO 18	4987.61	On ½" rebar by base of curve sign on E side of 3rd Ave. approx. one mi. N of Goldenstein Ranch.
BO 19	4949.79	On ½" rebar set by speed limit, 25 mph sign, 1 block W of intersection of Spring Creek Dr. and S. 3rd.
BO 20	4910.62	On middle "c" in word Pacific on top of fire hydrant on NE cor. of intersection of S. Willson and 3rd and Kagy Lane.

TABLE 17 (Cont'd)
TBM DESCRIPTIONS FOR BOZEMAN CREEK

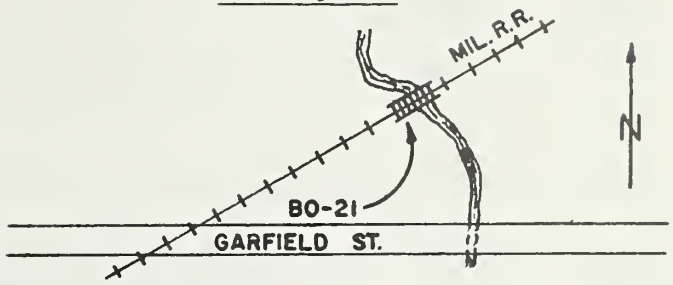
TBM No.	MSL Elevation	Description
BO 21	4864.85	 On head of bolt on SE corner of RR bridge across first creek NE of Garfield St.
BO 22	4842.70	Top of bolt on SE cor. of Milwaukee RR bridge across Bozeman Cr. first bridge SW of So. Church.
BO 23	4812.92	Fire hydrant corner (NW) Church and Babcock-- first "c" in Pacific.
BO 23-A	4811.15	Spike in light post NE cor. S. Rouse & E. Babcock.
BO 24	4805.18	Fire plug NE corner E. Mendenhall & No. Church. 
BO 25	4782.09	Fire plug SW corner E. Peach and No. Church. 
BO 27-A	4825.22	On NE cor. of intersection of E. Koch & S. Bozeman.
BO 30	4817.28	West end of S headwall of Bozeman Cr. bridge on Olive St.
BO 23-A	4811.15	Spike in light post NE cor. S. Rouse & E. Babcock.
BO 31	4814.33	Center bolt fire plug SW cor. S. Bozeman & E. Babcock.
BO 32	4813.80	Center bolt fire plug SW cor. S. Black & E. Babcock.
BO 33	4816.00	Top center bolt head, fire plug at corner Tracy and Babcock.

TABLE 17 (Cont'd)
TBM DESCRIPTIONS FOR BOZEMAN CREEK

TBM No.	MSL Elevation	Description
BO 34	4814.39	Top of center bolt, top of fire plug at corner of SW Willson Ave. and W. Babcock.
BO 35	4811.75	Top center bolt head, top of fire plug at SE corner of Main St. and Tracy.
BO 36	4806.52	Top of fire plug at intersection of Mendenhall and N. Tracy--on first "c" in Pacific.
BO 37	4803.66	Top of center bolt, top of fire plug at corner of E. Mendenhall and N. Black.
BO 38	4805.83	Top center bolt, top fire plug at corner of E. Mendenhall and N. Bozeman.
BO 39	4801.01	On painted rock on top of and on west end of concrete wall--2' east of bridge on Mendenhall St. over Bozeman Creek--south end of bridge.
BO 40	4802.04	On middle "c" in Pacific on top fire plug at NE corner of N. Rouse and E. Mendenhall.

1/ Bozeman Creek (BO); Turning Point (TP)

TABLE 18

EAST GALLATIN FLOOD HAZARD STUDY

TBM DESCRIPTIONS FOR BEAR CANYON CREEK

TBM No.	MSL Elevation	Description
BE 1 [1/]	4991.25	Steel pin at base of Bear Canyon sign at intersection of Bear Canyon Creek Road and paved road.
BE 2	5029.81	Steel pin across county road from Hoell's mail box.
BE 3	5053.19	Wooden hub at south gate of school yard Bear Canyon School.
Be 4	5070.01	Wooden hub at gate going to corral on west side county road.
BE 5	5118.92	Wooden hub 13' N. of L. Ligtenberg's mail box.
BE 6	5172.29	On rock at base of rock outcrop on E side of county road.
BE 7	4996.77	Spike in post SW wing wall on bridge over Bear Canyon Creek.
BE 8	4983.49	Wooden hub 100' SE of baseball backstop at base of power pole on E side of street.
BE 9	4976.68	Wooden hub 45' E of Frank King's mail box at base of power pole transformer.
BE 10	4953.88	200' E gas booster station on NW end of trailer court on highway R/W marker E-W section line.

1/ Bear Canyon Creek (BE)

TABLE 19

EAST GALLATIN FLOOD HAZARD STUDY

TBM DESCRIPTIONS FOR ROCKY CREEK

TBM No.	MSL Elevation	Description
R 1 1/	4993.65	Steel pin at base of telephone pole No. 16925 in W borrow pit of frontage road.
R 2	5023.21	Steel pin at base of telephone pole No. 16905 in W borrow pit of frontage road.
R 3	5040.28	Steel pin at base of power pole in E borrow pit of frontage road.
R 4	5005.52	Steel pin at power pole with transformer 200' SE of steel maintenance shop and 130' NW RR crossing.
R 5	4992.07	300' east of Bear Canyon Road sign 100' west RR on east shoulder of frontage road.
R 6	4954.79	Steel pin on NE shoulder of frontage road, 100' NE of milepost 313 on Interstate 200' east William Cernohlavek mail box.

1/ Rocky Creek (R)

SOIL CONSERVATION SERVICE
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